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CONSERVING OUR NATURAL RESOURCES, A 4-H LEADER'S GUIDE.

BY- AMICK, W. ROBERT AND OTHERS
DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.
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AN EFFECTIVE 4-H CONSERVATION PROGRAM IS DEVELOPED AROUND THE FOLLOWING BASIC CONCEPTS--(1) MAN IS A PART OF THE NATURAL WORLD, IN WHICH THERE ARE MANY VALUABLE MATERIALS, (2) MAN HAS LEARNED TO USE MANY OF THOSE MATERIALS FOR HUMAN SUSTENANCE AND BETTERMENT, AND (3) MAN'S ECONOMIC, SOCIAL, AND GENERAL WELFARE IS LARGELY DEPENDENT UPON THE MANNER AND EXTENT TO WHICH WE UTILIZE AND MANAGE OUR NATURAL WEALTH. IN ORDER TO PROMOTE CONSERVATION BY 4-H MEMBERS, A COMMITTEE OF FEDERAL AND STATE AGENCIES AND INDUSTRY GROUPS WAS ORGANIZED TO PREPARE THIS LEADER'S GUIDE WHICH PRESENTS FIVE SECTIONS DEALING WITH THE CONSERVATION OF SOIL, WATER, FORESTS, GRASSLANDS, AND WILDLIFE. (ES)

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CONSERVING OUR NATURAL RESOURCES

A 4-H LEADER'S GUIDE

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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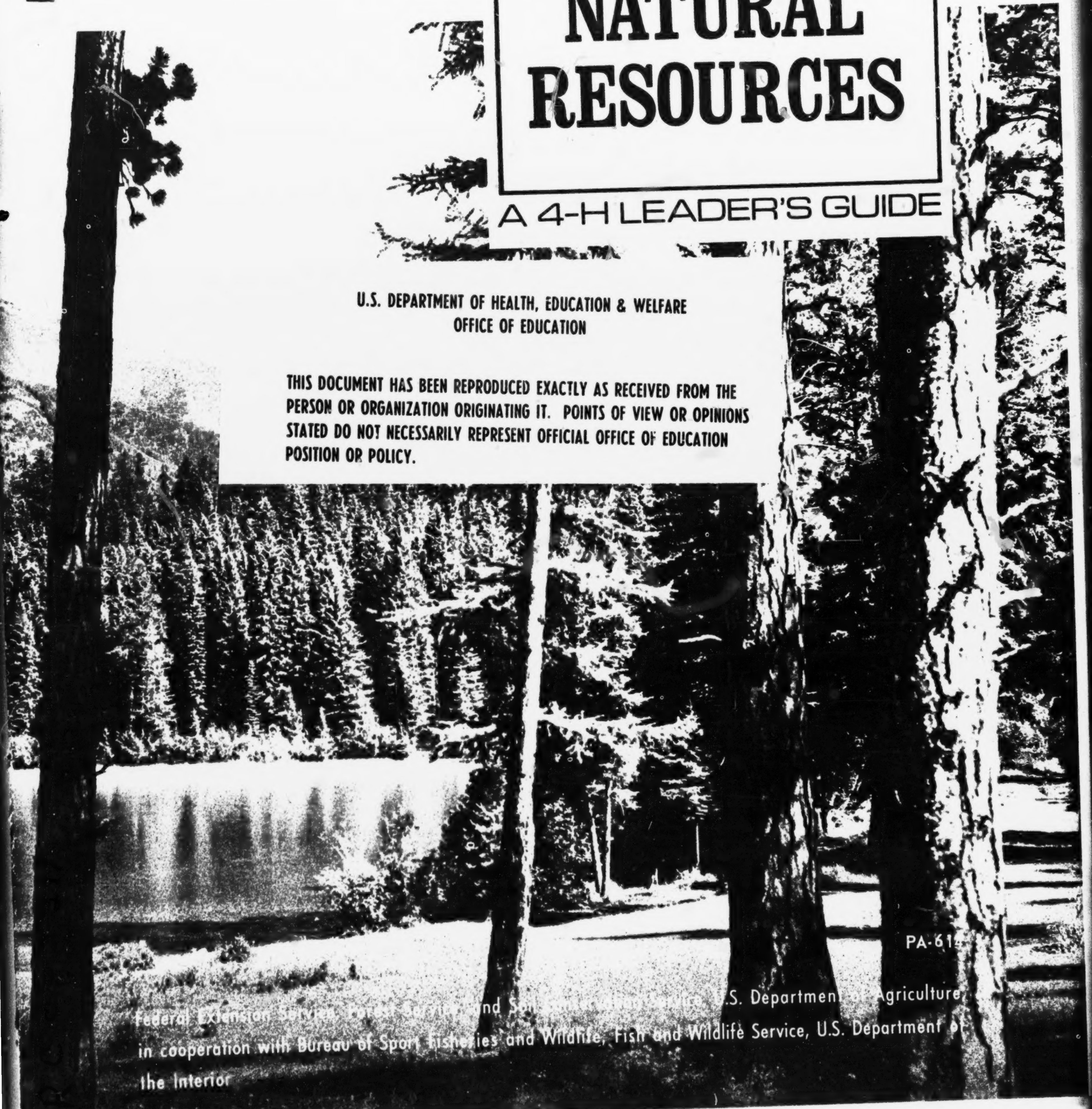

PA-614

Federal Extension Service, Forest Service, and Soil Conservation Service, U.S. Department of Agriculture, in cooperation with Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, U.S. Department of the Interior

A NOTE TO LEADERS

Extension workers and leaders like yourself have felt the need for a comprehensive guide dealing with natural resources and their interrelationships.

As a result, a committee of Federal and State agencies and industry groups was organized to prepare this leaders' guide. The committee had one goal in mind—helping you help your 4–H Club members better understand our Nation's resources through an integrated approach to conservation.

For example, the section on forestry deals not only with trees, but with the role of forests in conserving soil, water, and wildlife. Likewise, it is impossible to understand wildlife without knowing about the soils, water, forests, and grasslands which provide them with the necessities of life. It is important that your club members—both farm and nonfarm—understand the relationship between living things and their environment.

Your county extension agent and State and Federal specialists stand ready to help you. They have materials designed to suit the particular needs of your area. They will also help you and your 4–H Club members plan interesting, helpful programs.

The conservation of our Nation's natural resources depends to a great extent on your success in working with today's youth.

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INTRODUCTION

4–H and You—Leadership Opportunity

The prime goal of 4–H is to develop the boy or girl. Anyone interested in youth can find ways to help them grow into mature, competent young adults.

You can find many ways to exert leadership for youth in your community. Use your imagination in developing new ideas and using projects, activities, and the talents of many people. Your interest and initiative are the main ingredients of good leadership. Be flexible in accepting change in this scientific world of today.

> "Changes in Extension Youth programs reflect the changing needs of young people and the changing times in which they live. Today's philosophy of youth work has departed from the early belief that knowledge about subject matter was the only end to be achieved. New emphasis is being placed on how well the boy and girl learns to make decisions." (Scope Report, 1959.)

As a 4–H leader, you can assist by keeping the following important activities in mind as you work with county extension agents and others for the benefit of youth and the community:

1. Plan programs and activities that meet the needs and interests of the age group involved. Plan them with the youth themselves.
2. Involve the parents in every way possible. Good parental support nearly always insures success:

INFORM PARENTS + ASK PARENTS = PARENT COOPERATION.

3. Many other program areas are related to conservation projects. See how you can tie in some of the following:
    a. Career Exploration.
    b. Citizenship (including international aspects).
    c. Economics (management and decision making).
    d. Health.
    e. Leadership.
    f. Safety.
    g. Science.
    h. Recreation (as related to knowledge, attitudes, and skills involved in conservation—applies to such activities as camping, hunting, fishing, and hiking).
    i. Rural Areas Development.
4. Your 4–H'ers will not be content just to look and read, but will want to become involved in actual conservation work. They should plan what to do with a particular area that needs treatment and then carry out the plan.

Your Responsibility in Resource Conservation

An effective 4–H conservation program is developed around basic concepts.

American young people, both urban and rural, need to understand that man is a part of the natural world in which there are many valuable materials. Man has learned to utilize them for human sustenance and betterment. These resources include soil, water, forests, grass, fish, and wildlife. Our economic, social, and general welfare is largely dependent upon the manner and extent to which we utilize and manage this natural wealth.

SOIL

SOIL

Our young people need assistance in establishing their own position in the calendar of the earth's history. They need to understand the causes of barren and gullied lands; forest, grassland, and groundwater depletion; disappearance of wildlife; and they need help in appreciating esthetic values.

It is essential that young people become alert to the problems arising from resource use. It is likewise essential that they understand the role of State and Federal agencies and organizations, groups, and individuals, who are concerned with the management of these resources. And too, it is important that youth recognize the many career opportunities in all aspects of conservation. These include technical agricultural positions with the Extension Service, Soil Conservation Service, and other agencies working with farmers and ranchers. The Forest Service uses conservation-trained men and women, as do many bureaus of the Department of the Interior, including the Fish and Wildlife Service, Bureau of Land Management, National Park Service, Bureau of Reclamation, Bureau of Indian Affairs, and Geological Survey.

Other agencies in Federal, State, and county governments use trained conservationists. Many private groups, such as conservation organizations, implement companies, bankers, fertilizer producers, and seed distributors, have found well-trained conservationists an important asset to their businesses. The schools—elementary, high school, and college—are also demanding teachers who are trained to teach conservation.

You and Soil

One "H" in the 4–H emblem stands for Health. Every 4–H boy and girl knows it takes a lot of good food to produce and maintain the health needed for an active life. They know that foods like corn, wheat, lettuce, carrots, spinach, and many others needed in the daily diet come from the soil. They also have learned that milk, steaks, lamb chops, bacon, and eggs come from cattle, sheep, hogs, and poultry produced by grass and grain that grew from the soil.

You may have a 4–H boy or girl in your club who fed and showed a calf or lamb as a club project. They might be reminded that the wool of the lamb and the hide of the calf may have been used to make clothing and shoes. Much clothing comes from products produced on the land.

Soil is a basic natural resource that must be maintained and used wisely to give the greatest benefit to all who depend upon it for food, clothing, shelter, or the many other things that add to the joy and comfort of living.

Importance of Soil

Man has usually taken soil for granted. Early civilizations of the Middle East, North Africa, and China flourished as long as they had an abundance of productive soil, but when the soil was destroyed by overuse and erosion these early civilizations declined.

When the early settler in this country found that the land became less productive with use, he pushed westward where the open prairies provided a soil that produced bigger and better crops. As these lands became more densely populated and the farms smaller, he moved still farther west.

Most of the arable land in the United States is now being used. Some of it needs better use and protection with soil and water conservation practices; other land will be used more intensely as the increasing population demands more products. There is only so much land. The 1960 census showed 1,100 million acres of land in farms and ranches in the United States. About 450 million acres are now used as cropland.

Soil is contoured into alternate strips for corn and hay near a Minnesota lake. The marshy area at lower right is a wildlife refuge, while cattle graze a nearby pasture.

Most of the best land is now in cultivation. More land may eventually be brought into cultivation through irrigation, fertilization, or some other intensive conservation practice, but the amount added probably will little more than offset the acres being lost to erosion and to roads, urban developments, airports, and other uses—about 1 million acres annually.

What Is Soil?

Simply stated, soil is the part of the earth's surface that supports plant growth.

Soil is composed of rocks and organic materials; no soil as we know it existed until life appeared upon the earth.

Dr. Roy W. Simonson, writing in *Soil, the 1957 Yearbook of Agriculture,* says:

> "Soil is related to the earth much as the rind is related to an orange. But the rind of the earth is far less uniform than the rind of an orange. It is deep in some places and shallow in others. It may be red, as soils are in Hawaii, or it may be black, as they are in North Dakota. It may be sand, or it may be clay.
>
> "Be it deep or shallow, red or black, sand or clay, the soil is the link between the rock core of the earth and the living things on its surface. It is the foothold for the plants we grow."

Soil chemists tell us that plants require at least 16 chemical elements to grow. These are carbon, hydrogen, oxygen, nitrogen, phosphorus, sulfur, potassium, calcium, magnesium, iron, manganese, zinc, copper, molybdenum, boron, and chlorine.

Most of the elements necessary for plant growth are readily available. But some are lacking in certain soils and must be supplied. Nitrogen, phosphorus, and potash are often among the missing.

Soil testing kits used in the field show soil deficiencies. So do offcolor leaves and other physical characteristics of crops. But the most reliable method is laboratory analysis of carefully taken soil samples.

Not all soil is topsoil. Typical soil is made up of three layers or "horizons": topsoil, subsoil, and parent material. In the course of soil development, plant and animal remains accumulate in the surface layer. Topsoil that is high in organic matter is readily permeated by water, air, and plant roots.

The subsoil just below the topsoil is usually more compact and contains more clay and silt than the soil above. It is harder for roots to penetrate this layer, but it does contain minerals that are valuable for plant growth. The subsoil anchors deep-rooted plants in the soil and holds those like trees erect as they grow high into the air. The subsoil is usually lighter colored than the topsoil.

The third layer, the parent material, is below the subsoil. It may be rock fragments, glacial debris, stream sediment, volcanic ash, or other material from which soils are formed.

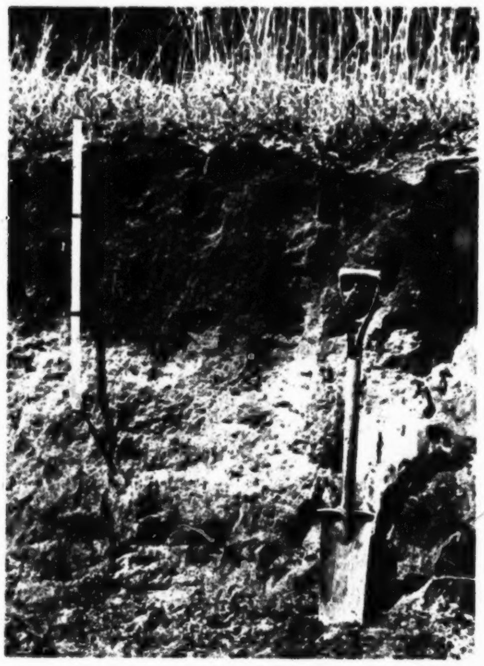
The size of the soil particles indicates soil texture. Sandy soils have rather large particles that can be seen with the naked eye, while others like the silts and clays have particles so small they must be examined under a microscope. It is the smaller clay particles that fill up the pores and stop proper soil drainage and aeration.

The field soil scientist moistens the soil and rubs it between his fingers to determine soil texture and the approximate amount of sand, silt, and clay present. Laboratory examinations can determine the size and amount of particles and verify the field man's judgment on soil texture.

Like a building, the way soils are put together is called structure. Farmers know that granular structure is good. It is like crumbs from bread or cake. Many fine particles cling together to form granules that behave like larger particles. Decayed organic matter or humus in the soil helps to form granules.

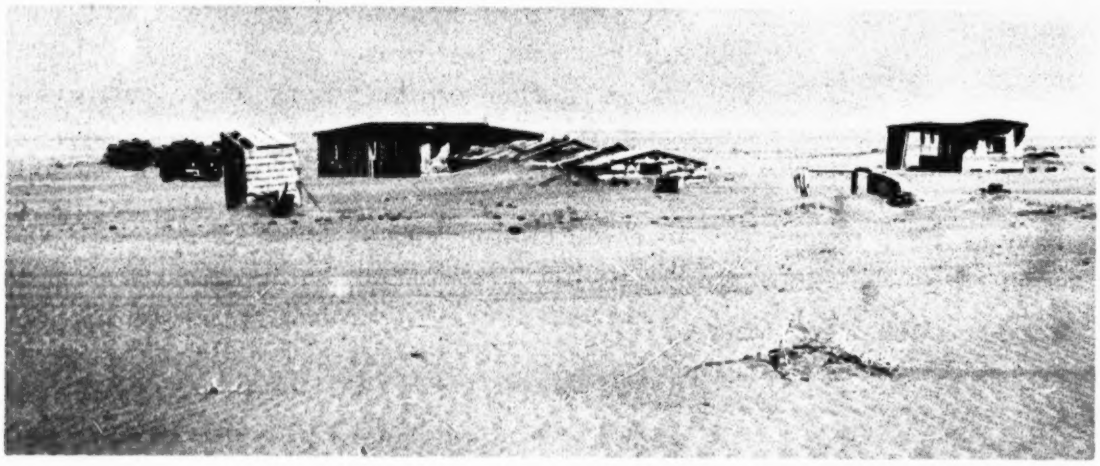
Take a handful of good topsoil and you will see and feel how it is put together. You may have heard people speak of "light" and "heavy" soils. A sandy soil with few clay particles is "light soil" while a soil with predominantly clay particles is "heavy soil." Heavy soils are hard to work. They tend to stick together and form clods if worked when too wet. But if a soil high in clay has good structure—that is if the particles are grouped together as granules—it will provide ample pore space for root growth and will not be easily carried away.

Wind, water, and weather carved Zion Canyon, Utah. Broken rock forms the mineral basis of soil.



This "soil profile" shows the layer of dark loam under grass; the subsoil and parent material are well defined.

At right: Taking a soil sample.



An abandoned farmstead stands ruined by wind-shifted soil.

Uncontrolled water caused this sheet erosion and silting in an Illinois cornfield.

Granular soil structure also lets water sink into the ground easily and holds it for plants to use later, rather than letting it run off. Since running water picks up loose particles of soil as it moves over the ground, granular soil structure helps control erosion.

How Soil Is Made

Soils are made of rock, plant, and animal materials. These materials are broken down and incorporated into the earth's surface in many ways.

Physical changes are brought about by alternate freezing and thawing, by rocks moving along streams or being tossed by wind, and by sand and silt particles wearing against each other. Plant roots penetrate the cracks and crevices of rocks and break them apart. In some places glaciers, moving on the earth's surface, grind rocks and mix them, forming a mass of finely ground rock dust. Even the small burrowing animals like ground squirrels and earthworms contribute to the physical process of soil making.

Plants and animals not only aid in the soil-making process, they eventually die and decompose to become part of the soil. This decomposing process is caused by micro-organisms, bacteria, and fungi. These tiny workers return nutrients to the soil and make them available for new plants. Partially decomposed organic matter is sometimes called humus.

The chemical changes constantly taking place in soil are not easy to see, but we can observe limestone rock melting away when a weak acid is poured on it, or iron rusting when exposed to moist air. Chemical changes in the soil may have as much influence on soil-making as physical action.

We see the importance of conservation when we realize how slowly these processes operate—that it might take a thousand years to form only one inch of topsoil.

How Soils Decline

Nature endowed our country with an abundance of rich soil and valuable minerals. Both come from the rocks found in the crust of the earth, and both, if used carelessly and without thought of their conservation, will ultimately become exhausted. A depleted soil can be restored, but a destroyed soil cannot be rebuilt. Wasted minerals are lost forever.

Geologic or natural erosion of rocks is the first step in the formation of soil. Man-made or accelerated erosion has scattered soil to the wind or washed it from the slopes.

The early settlers found natural resources plentiful in much of our country, but the desire to produce grains for food and feed for livestock prompted the pioneer to cut the trees and plow up the grass. As the crops were removed, some plant nutrients from the soil were marketed as grain or livestock, and some washed down the river or blew away. As man used more modern machinery, he worked with soil harder and more frequently, exposing more of it to water and wind, often resulting in severe erosion.

Soils lose their productivity in many ways, but wind and water erosion are soil's greatest enemies. Man-made erosion destroys soil productivity faster than it can be restored.

Water erosion—Raindrops hit the ground with such force that the splash actually moves soil from its original location. As the water accumulates on the ground, it seeks lower levels, carrying with it the soil that has broken loose. As the slope becomes steeper or the length longer, more soil is washed away, causing severe sheet erosion and sometimes gullies.

Wind erosion is more severe in dry areas, but it occurs any place where high winds blow on loose unprotected soil. The dust storms of the 1930's and early 1950's proved that wind could move large amounts of soil. Each year thousands of unprotected acres are damaged to some degree by winds. Fields well protected with vegetation—crop residues, trees, or grass—will not be damaged severely regardless of how dry it gets.

Where plant cover protects the soil, the soil remains in place, streams run clear, and fish are more plentiful.

Why Soil Conservation?

An efficient, productive agriculture is vital to the welfare of our people as individuals and as a nation. Because our farmers and ranchers have produced an abundance of food and fiber, Americans have not had to worry about having enough to eat and wear. Because farmers and ranchers are so efficient, the remaining people can spend their time doing other things such as research, teaching, producing nonagricultural goods, and the multitude of other things that go to make a thriving civilization.

On the average, Americans spend only about 20 percent of their income for food. In some of the other leading nations this runs as high as 50 to 60 percent. Thus our people are able to spend more for other things that contribute to a high standard of living.

Our farmers need to continue producing efficiently to keep our food costs as low as possible. Each year our population increases by about 3 million. By 1980 it is expected to reach 240 million. So our farmers and ranchers have their job cut out for them.

To produce efficiently, farmers need productive soil. If they manage it properly, our soil can meet this country's needs for a long time to come.

What Is Modern Soil Conservation?

Modern soil conservation involves many scientific and technical fields. These include soil science, agronomy, engineering, woodland and wildlife management, and others. The farmer or rancher can apply this varied knowledge on his particular farm or ranch by developing a conservation plan, usually with technical assistance from the U.S. Soil Conservation Service and other agencies. This technical assistance is usually available in soil conservation districts, which are legal subdivisions of States, voluntarily created and operated by landowners.

Since no two farms or ranches are alike, no two conservation plans are alike. Each must be tailored to fit the needs of the particular farm and the farmer.

In developing a conservation plan, the farmer or rancher and the technician usually agree on two major points: (1) how to use the land, and (2) what conservation practices will protect it while in that use. Will it be used for trees, grass, cultivated crops, wildlife, or recreation? You need to know about the soil to decide how it should be used. This information comes from soil surveys made by specialists.

The soil scientist examines the soil, using a soil auger or spade to get down to the underlying layers. He doesn't just examine it on top. Some things he checks for are the depth of the soil, its texture, color, structure, how wet or dry it is, how well drained it is. He sees whether it is subject to erosion or flooding, and looks for other characteristics that have a bearing on the use of the soil.

From this detailed information, the soil is classified according to how it can be used. The land capability classification is one way of grouping soils with similar characteristics. It is based on the risk of soil damage—from erosion, flooding, dryness, or other hazard. For example, some soils erode so easily that they cannot be cultivated and must be kept in grass or trees.

After the farmer decides how to use different parts of the farm, he and the conservation technician agree on the practices needed to protect the soil. On sloping cropland they might find that terraces will be needed if corn or some other clean tilled crop is to be grown every third or fourth year. Or, they might find the farmer can use stripcropping by reducing the proportion of corn to hay crops. They will probably agree that grassed waterways are needed in the draws to prevent gullies from forming. Other practices usually include using lime and fertilizers according to the soil tests, controlling grazing on pasture land, and fencing to protect woodlands from grazing. It takes a combination of conservation practices for sustained high production.

Farmers should put conservation plans into action promptly. Terraces, grassed waterways, and other plant cover all help keep the soil where it belongs. Trees and shrubs also provide homes for wildlife. As a plan is applied, erosion comes under control, gullies are healed, soil fertility is built up, and the farm becomes more productive and efficient. These important conservation measures take money, which the farmer sometimes is not able to afford. To assist and encourage a farmer in this conservation work, the government, through the Agricultural Conservation Program, may pay up to half the cost of approved practices.

The farmers and ranchers who are following soil and water conserving practices on thousands of small watersheds throughout the United States, Puerto Rico, and the Virgin Islands are helping control erosion and floods. Farm conservation measures often help nonfarmers more than farmers. These measures conserve and improve our national agricultural resources, protect our streams from sediment and pollution, provide wildlife habitat, add beauty to our surroundings, and preserve and create recreational areas.

Soil and water conservation can be applied anywhere, no matter how small the piece of land may be. Whether land is urban, suburban, or rural its wise use or abuse affects everyone in some way.

Interrelationships With Other Basic Resources

Soil is very closely interrelated with other natural resources.

Water, for instance, both helps and hinders. It grinds rocks into soil. But it can erode. Water working with soil nutrients is necessary for plant growth, but too much can leach out nutrients.

Very few plants would grow without soil. Without plants there would be little animal life, and civilization as we know it today would not be possible.

Things 4–H Club Members Can Do

1. Importance of Soil: Ask club members to list 10 things they use every day—paper, pencil, shoes, etc. Help them determine how many items on this list come from the soil either directly or indirectly. They will find that most come from plants or from animals that feed on plants, and thus from the soil.

2. Field Trip: Arrange for a field trip with an agronomist, soil conservationist, geologist, county extension agent, etc. Have members: find three kinds of rock and learn how they were formed; determine what kinds of soil come from these rocks; and find examples of several minerals commonly found in rocks in your area.

Find a steep bank along a stream, highway, or railroad cut where the transition from bedrock to soil is exposed. Have the members study and describe the changes that take place in the rock-to-soil process.

A monolith or soil profile can be used as a visual aid for a talk on soil development if it is impossible to have a field trip. In many places, these may be borrowed from the Soil Conservation Service.

3. Soil Formation: Have members learn the effects of geologic erosion; what kinds of rocks, when weathered, make the best soils; what rock characteristics are responsible for good or poor soils.

Have boys and girls compare soil from an intensely cultivated field with soil from a natural sod fence corner. Point out any differences in the organic matter present. They can also examine the litter from an ungrazed and unburned woodland which has grown trees for many years. The basic mineral soil will be covered with several inches of accumulated organic matter.

4. Stream Sediment: Have the club members collect muddy water from a nearby stream in a clear glass bottle or jar and let it set for 12 hours or more without disturbing. How much soil settled out? Ask the 4–H'ers to suggest places the mud may have come from. They can grow beans or some other seeds in it to see how fertile it is.

5. Land Judging—Soil Mapping: The 4–H boy or girl who wishes to know more about soil should examine many different soils under various conditions. Working with a soil scientist in the field and participating in land-judging contests are excellent ways to learn. Members can make a basic soil map to locate the different soils. A county agent, soil scientist or soil conservationist can explain a soil map and help make one.

6. Conservation Projects: As club members learn more about soils, their use and conservation, they will want to apply what they have learned. Demonstration projects may be carried out on a farm, on a lawn, in a community garden, or on a vacant lot. It may be possible to demonstrate several conservation practices on one plot. Terracing, cross-slope cultivation, grassed waterways, windbreaks of trees or tall-growing annual, composting, mulching, fertilizing, grass seeding, and many other practices may fit into the member's plan.

The farm youth has many conservation projects he can carry out with his father or a neighbor. The city boy or girl can make a garden plan and use grass clippings, leaves and other vegetable or animal refuse to build up the soil's organic matter and make it more productive. Club members can plant grass or other ground cover on bare spots to control soil erosion, or plant shade trees, vines, flowering shrubs, and flowering plants to make a lawn more attractive. Help them select plants that will produce seeds, fruit and berries to attract birds.

The club camp area may offer an excellent opportunity for 4–H boys and girls to practice conservation. Many eroded areas can be corrected by preventing excessive use and by planting grass and trees. Trails can be made around a hill and runoff water can be diverted from gullies.

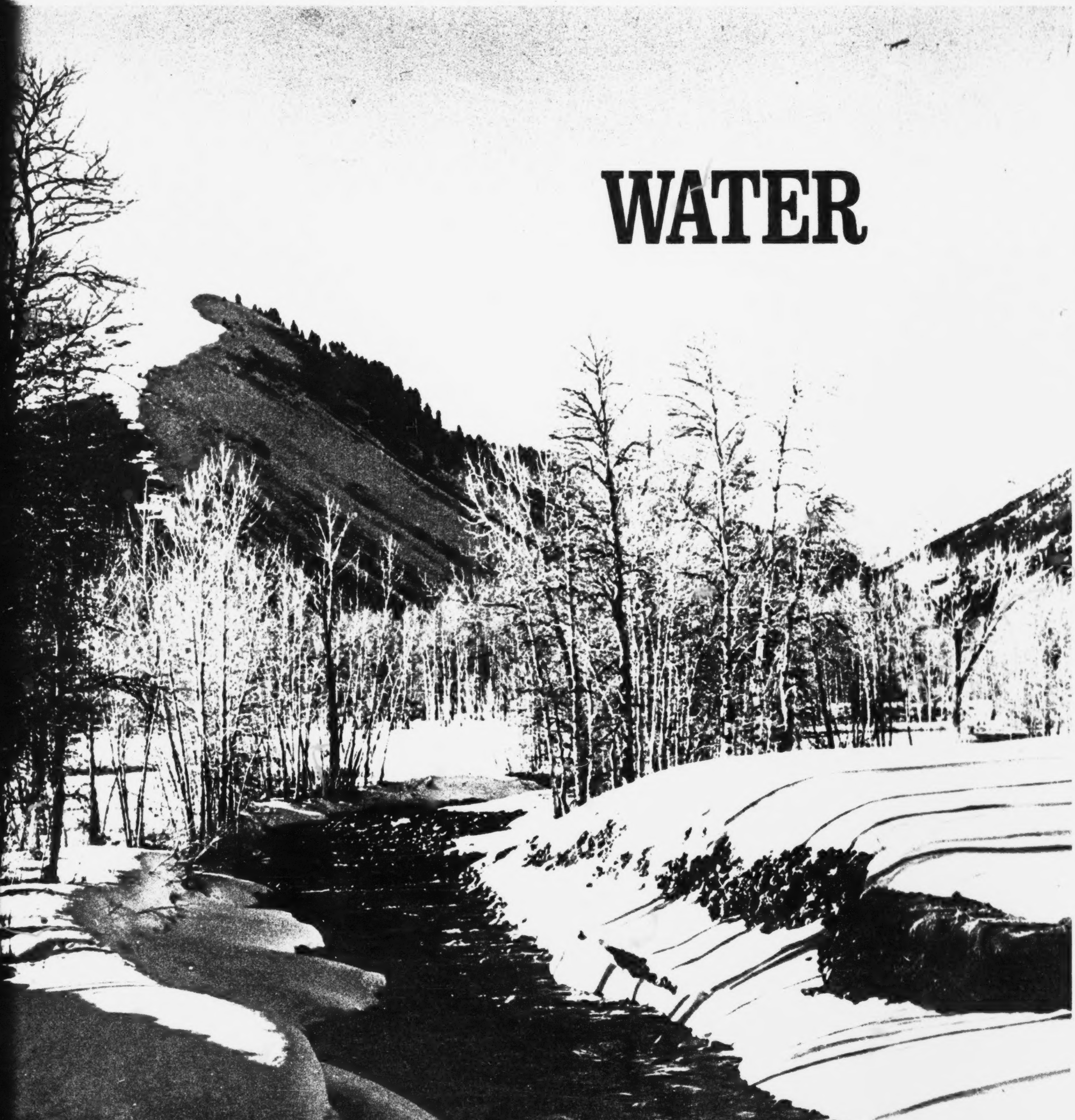
Wind and water erosion projects can also be carried out on sand dunes, highway roadsides, streambanks, ponds, and lakeshores. Try to find a sponsoring group such as a soil conservation district, conservation club, garden club, civic club, or other organization when planning and carrying out large conservation projects. Technical and financial help may be obtained from State and Federal conservation agencies or other sources. Be sure to make arrangements with the land owner or person in charge of the land—farmer, rancher, road supervisor, park superintendent—and obtain his permission and cooperation.

7. Exchange Visits: Members of urban and rural clubs may want to exchange visits for a weekend or longer. This may be done as a club project or by arrangement with individual members and their parents. Careful advance planning will help members learn more about conservation and understand each other's way of life.

8. Exhibits: Displays and exhibits can be set up in public places during Soil Stewardship Week, 4–H Club Week, Conservation Week, and other appropriate times. They can show bulletins, books, pictures, charts, posters, and models of a conservation farm, ranch, lawn, or garden. Ask your county agent or someone skilled in making exhibits to help your club members develop theirs.

Club members can make a soil profile for study and display at county fairs, science fairs, and elsewhere. They can also collect the common rocks in their area, identify the common minerals in them, then make an exhibit of these rocks, their weathered products, and the characteristic soil from each.

Other activities may be suggested by the references listed at the back of this booklet.



WATER

WATER

Importance of Water

Water has many functions. We use it for drinking, for preparing food, for washing our bodies, clothing and household goods, for removing wastes, for watering lawns and gardens.

Water turned the wheels of the earliest mills. Today it turns the wheels of mighty hydro-electric plants that furnish light for our cities and power for industries. And most of the power not created by moving water is created by water in another form—steam.

The ancient Egyptians used the waters of the Nile to irrigate their land more than 5,000 years ago. Today in the United States we deliver some 30 *trillion* gallons of water per year to farms and ranches to irrigate more than 39 million acres of land. Another 8 *trillion* gallons are lost through seepage from the irrigation canals, laterals, and ditches, and never reach croplands.

Water is still a highway. Inland waterways in the United States—not counting the Great Lakes—carry billions of ton-miles of freight each year.

Today we are making more demands upon our water resources than ever before. The most important new uses center around industries. In 1960 it was estimated that U.S. industry used 140 *billion* gallons of fresh water every day. And these figures do not include the stream flow used to create power.

Water carries wastes away from homes, cities, and factories. This use has always been important; today, it is threatening to cut down or completely prevent other uses.

Water is important to recreation—for beauty of landscape, to support fish and wildlife, for the fun of swimming and boating.

Water and soil together support forests and grasslands. The kinds of plants that can live in a place depend largely on the amount of rainfall.

And trees, plants, and grasses, in turn, protect water and soil. Where there are many plants, their roots hold the soil in place. When it rains, they hold water on the land. But where there are few plants, water runs over the surface, carrying soil with it. Streams become muddy and deep gullies appear on the land. Worst of all, many tons of precious soil are carried down the rivers to the ocean, lost forever to our use.

Water maintains our wildlife resources—not only fish and other water-life, but also mammals and birds. It is easy to see why water has been called "the key to Nature's treasure-house".

The Water Problem

The water problem is not one, but many. There is no national water shortage, but many communities must ration their water supplies. Every year floods strike scores of communities, yet hundreds of arid-land communities would greet a cloudburst as a godsend. Drought is a recurring hazard in the Great Plains, while drainage is a common problem in the Coastal Plain.

Nearly everywhere there's a water problem—too little or too much, too soon or too late.

The Water Supply

There is just so much water. Except for negligible amounts newly created or destroyed by chemical changes, the earth's water supply remains constant. But that supply is always on the move. From clouds in the sky to land and ocean, and back to the sky again—it goes through the water cycle, and we use the same water again and again. Uneven distribution and irregular timing give rise to most problems of local water shortage or excess.

Clear, unpolluted streams are the lifeblood of America.

Weather Bureau records show that the average annual precipitation (rain, hail, snow, sleet) in the United States, if spread evenly over the surface, would be about 30 inches—or 4,300 billion gallons a day.

Total stream flow derived from surface runoff and ground water amounts to about 8.5 inches a year, or about 1,200 billion gallons a day. That is more than four times the amount we use now—two times what scientists predict we'll need in 1980.

Water and Land

Since lakes and streams occupy less than 2 percent of the area of the United States, about 98 percent of the precipitation falls on land. Whether the water enters the ground or runs off depends upon the nature and condition of the soil and its vegetative cover. Also, the capacity of the soil to store water within reach of plant roots varies with soil type and condition. The management of watershed lands influences what happens to the 4,300 billion gallons a day of precipitation that must replenish our water supply.

About 70 percent of the water reaching the land surface, or 3,100 billion gallons daily, is transpired in the growth of plants or evaporated directly from the soil and other surfaces. How much of this combined requirement, called "evapotranspiration", actually passes through the plants is not known. But plant growth consumes tremendous amounts of water.

Water is a primary resource. Next to air, water is our most important resource for survival. You can live longer without food than you can without water. Farmers and ranchers control to an important degree the movement of the water that falls on their land.

Water for Human Use

Although there is plenty of water in the aggregate, one-fourth of this country's population today faces problems of water shortage, poor quality, or both. And the prospects are for even more difficulty in the future. A most serious problem is disposal of waste—and water pollution.

While the potential supply of water after "evapotranspiration" remains constant, needs for human use increase with growing population. Expanding industry and rising standards of living require more water per person.

From 1900 to 1950, while the U.S. population doubled, total water use, other than for power, increased more than fourfold. By 1955 it was up another 21 percent. Water needs are expected to double again by 1980.

Average daily use for all purposes increased from 600 gallons per capita in 1900 to 1,100 gallons in 1950 and 1,300 in 1955. By 1980 the country will be using 2,300 gallons of water a day for every man, woman, and child.

Water for Industry

Industry now exceeds agriculture in total water withdrawals. Water is industry's most important raw material. Depending on the methods used, production of a ton of steel requires from 6,000 to 110,000 gallons of water. Producing a thousand yards of woolen cloth requires 40,000 to 51,000 gallons of water.

Industrial users needed an average of 140 billion gallons of fresh water a day in 1960. It is predicted that the 1980 use of industrial water will be 363 billion gallons a day. Fortunately, nearly 98 percent of water withdrawn for industrial use is returned to streams or other natural storage and can be used again.

Irrigation still is the greatest single consumer of water. Growing crops require a lot of water. It takes 115 gallons of water to grow enough wheat to make one loaf of bread.

The rapid spread of urban areas brings a like expansion of municipal water systems. In 1960 the Nation's cities and towns used 21 billion gallons of water a day. It is estimated that total water needs of municipalities will reach 29 billion gallons a day by 1980. In some areas, urban growth already is hampered by limited water supplies.

Controlling Pollution

Most uses of water, except for generating power, damage its quality—they raise the temperature, alter the chemical nature, add to the suspended-sediment load, or all three.

Wastes from factories, sewage, salts leached from the soil, sediment—all lower the quality of water. Many of the Nation's streams, including some large ones, already are little better than open sewers.

Control of water quality is a problem of management. The quality of stream waters will be as bad as management permits it to become, or as good as the public demands that it shall be.

During the next 20 to 30 years, the principal problems will be efficient use of water and quality control.

Water for Recreation and Wildlife

Water is the key element in many kinds of recreation. It is indispensable to wildlife, which in turn provides recreation. Irrigation and industry often diminish the supply and value of water for recreation and wildlife. This poses water problems of increasing importance as our population grows and more people live in cities and have more leisure time. Swimming, boating, fishing, and certain kinds of hunting depend on suitable bodies of water.

Recreational waters need to be clean and located in pleasant settings. The water level must be stable enough to avoid exposing mud flat or leaving boat docks stranded. Conflicts arise from uses that pollute streams, lakes and coastal waters; that dry up streams and lower lake levels; or that place obstructions like dams in the path of migrating fish.

Wildlife conservation, aside from recreation, involves other water problems. Fish, waterfowl, and many other kinds of wildlife require suitable aquatic habitats to live and grow. If these habitats are destroyed or contaminated it threatens the wildlife supply.

Water Losses

Flash runoff robs communities of part of their natural water resource. Peak flows that exceed storage facilities are an economic loss, besides the damage they do as floods. Sedimentation that reduces storage capacity, evaporation that dissipates stored water, and pollution all reduce the usable supply.

Watershed Protection and Conservation

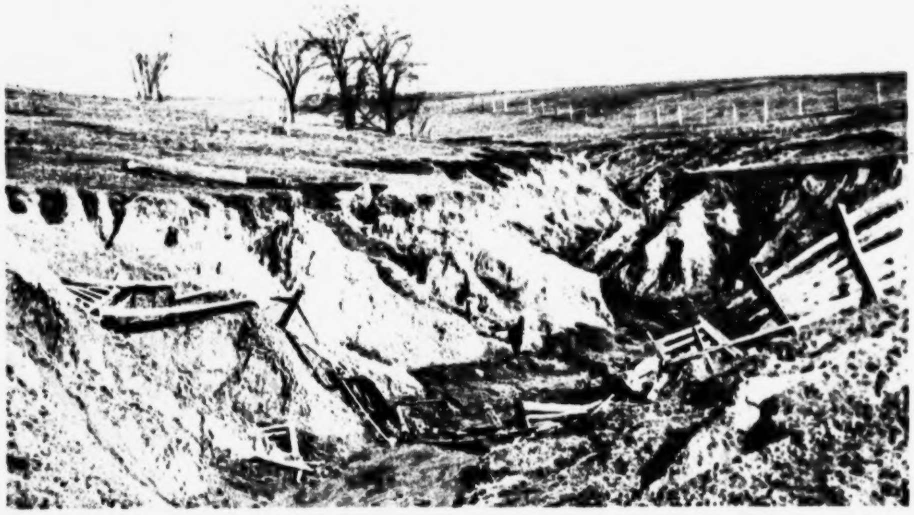
Water problems are watershed problems. A watershed is any area of land that drains into a particular stream or body of water. Small streams, of course, flow into larger ones, so the entire country is a patchwork of small watersheds making up larger ones.

It is within watersheds that communities can manage their water resource to best meet their own needs. This takes teamwork. People must plan and act together to make the best use of all the land and water resources. Water control and conservation cannot be separated from soil conservation.

Rural and urban interests all over the country are joining in small watershed protection and flood prevention projects. These deal with all aspects of land and water conservation. Local, State and Federal agencies cooperate in planning, financing, and carrying out projects under the Watershed Protection and Flood Prevention Act. These projects combine soil and water conservation on the land with control and use of runoff by means of upstream structures in small watersheds. Improvements for industrial and municipal supplies or for wildlife and recreational facilities can be included at local expense. Federal cost-sharing is available for soil and water conservation and fish, wildlife and recreational development.

Raindrops land with enough force to move loose soil particles.

A dense stand of vegetation breaks the force of raindrops, allowing them to fall gently to the ground.



Before and after—The gully above resulted from torrents of uncontrolled water. The quiet pond, below, formed when an earth fill was built.

Properly stocked and managed farm ponds can provide recreation, fire protection, stock water, and wildlife.

Things 4–H Club Members Can Do

1. Uses of Water: Have the members compare uses of water in a modern city with those of a frontier settlement. Emphasize any differences in the problems faced by each community.

The 4–H'er can measure or estimate the amount of water used in his home in a single day. Have him list how much was used in each way and the total for the day. Have members check a leaky faucet to determine the amount of water lost per day.

2. Watersheds: Have the club members describe the watershed they live in. Be sure they include such items as soil conservation, forest and grassland management, and pollution control. Have them consider how the future of the community is related to the management of the watershed. Arrange a tour of a watershed project to see what methods are used to conserve soil and water and reduce floods.

Encourage members to collect water samples from ponds, lakes, marshes, rivers and reservoirs in the area. Examine them under a microscope and compare them with samples of pure drinking water.

3. Water Supply: Have the 4–H'er investigate the water supply system of his home and community to find out where the water comes from, its condition at the source, the treatment it receives and how it reaches the user. Arrange a field trip to the nearest water treatment plant.

Have members who do not have city water in their homes make a water sanitation check. Unsafe water may carry typhoid, diarrhea, internal worms, or cholera. A water sample bottle can be obtained from the county health department. Have the 4–H member take the bottle home and fill it from his water supply. Be sure he does not let the top of the bottle or the bottom of the lid touch anything. This would alter the test results. Mail the filled bottle to the testing laboratory suggested by State health authorities.

4. Sewage: A member can investigate the sewer system of his home and community to find out what happens to water after it goes down the drain, if sewage is treated and how, where it is finally discharged, and how it affects the water quality in the receiving stream. Arrange a field trip to the nearest sewage treatment plant. Be sure members understand what plants like this mean to their present and future health and comfort.

Have members whose homes are not connected to a city sewer line check the drainage area of their cesspool or septic tank. Is water seeping to the surface of the ground? Have them check some of this water under a microscope. They can seek help in correcting this problem from the county agent or local health department.

5. Aquarium: Members can set up an aquarium and learn how it works. This is a good way to teach the interrelationships of water and living things. Be sure the members understand what would happen if the water became polluted by the decay of excess food, what dissolved oxygen is and what it does, how water in the aquarium purifies itself, and what makes a balanced aquarium and why.

Other projects may be suggested by the references listed in the back of this booklet.

FORESTS

FORESTS

What Is a Forest?

A forest is a living community of plants, in which trees are the dominant species. From a distance, the forest appears to be just big trees. As we come nearer we see other plants—medium-sized trees and shrubs. Then, as we enter the forest, we see many small plants. Some of them are young trees. A few will eventually become giants. Shrubs, vines, herbs, wild flowers, and mosses also sprawl over the forest floor. This storied effect is called the forest structure.

The forest floor is an important part of the forest community—the base of the forest structure. If the forest floor is swept to remove the dead leaves, humus is exposed. A humus layer takes a long time to develop. It comes from the decay of forest litter—leaves, seeds, twigs, branches and dead plants and animals. This combination of decomposed plant and animal matter gives the soil under a forest canopy a granular, porous structure that makes it easy to "work."

Experts estimate that 2 tons of such debris are converted to soil on each acre of forest floor every year. Bacteria and fungi help to break down the debris. Worms, insects, mice, moles, and shrews also help produce a fertile soil. These forest dwellers find their food and shelter on the forest floor.

The root systems of plants are also important. They take up water and minerals, transport food materials, store food, and anchor the plants.

There is other life in the forest community—birds sing from the tree tops, frogs peep on the ground, grouse drum on a fallen log. Some can be seen but not heard—a snake slithers for cover, caterpillars devour a leaf, spiders wait on webs that glisten in the sunshine. Plants and animals compete for living room both above and below the surface of the ground. It is the joint activity of all the living things of the forest, as they live, grow, reproduce, and die, that makes for soil improvement.

A plant is a combination of elements. Carbon, oxygen, hydrogen, and nitrogen make up most of the plant and they come from air and water. From the soil come potassium, calcium, silicon, magnesium, phosphorus, chlorine, sodium, iron, sulphur, and trace elements.

The plant cycle—from plants to litter, to humus, and back to plants—depends on moisture, heat, nutrients and most of all, the sun. The right combination of these ingredients produces a continuous forest community.

A forest is a great organization made up of countless separate and indispensable parts. Whether the forest community can be maintained depends on the living things that use it for their existence and convenience. All living things in a forest depend on one another.

Importance of Forests

From the time explorers began to visit North America, they recognized the value of the vast forests in this new country. At once they began to harvest timber and carry it home to Europe. And so the forests provided one of the first businesses in America.

The forest saved the lives of the early colonists, unaccustomed to the rigors of New England winters. Their first homes were huts made of many layers of bark. Wooden boats furnished transportation. Indians taught them which nuts, greens, fruits, and berries were good to eat. They showed the settlers how to make sirup and sugar from maple sap, and how to make medicines from certain trees, shrubs, and herbs.

Forest animals provided furs to trade and meat to eat. The bark of some trees was used to tan hides into leather. Other tree products yielded dye to color homemade clothing, food seasonings, ink, tea, wine, and chewing gum.

A stand of poplars in the Chattahoochee National Forest.

Americans needed wood for covered wagons, bridges, ships, poles, railroad cross ties, and mine timbers. Houses, stores, schools, and churches had to be built.

People sometimes look back at our early days and shake their heads over the timber cutting and land clearing practices. But in those days, there was a tremendous surplus of timber. Trees had to be removed to make way for homesteading and farming. The easiest and fastest means of clearing land of trees was to burn them. Forest fires raged unchecked. Forest protection was unheard of because almost no one could see that the timber supply was not limitless.

By the 1870's, however, when settlement had reached the Pacific Northwest, men began to think about taking steps to insure a future timber supply. In 1905, the U.S. Forest Service was founded to improve and protect Government-owned forest lands. In recent years, sound forestry practices have become widespread on privately-owned and public woodlands.

Today, as in the past, wood is a way of life to Americans—vital to our national security, our economic strength, and our well being. We must have it—lots of it. It's in our homes, furniture, books and newspapers. More than 5,000 products come from the forest. The average U.S. citizen uses about 200 board feet of lumber, 450 pounds of paper, and untold amounts of other materials made of wood each year. In no other nation is the demand for forest products so great.

Because of the wide variety of climate and geography, the United States has many different kinds of trees—nearly 1,200. However, only about 100 are suitable for manufacturing into lumber, paper, and other products.

America's Forests Today

One-third of our Nation's land area (the statistics include coastal Alaska but not Hawaii) is forested, but not quite 80 percent of this can be called commercial forest land—land capable of growing trees as a crop.

A little more than one-quarter of this is owned by the public. National Forests make up two-thirds of the public land. Forest industries own 13 percent of the private commercial forest land; 3.4 million farmers and ranchers own 34 percent; and 1.1 million nonfarmers own 26 percent.

Generally, forest land is not suited to cultivated crops because it has poor soil, steep slopes, or is too hard to get at. But because of competition for land to use, the acreage of forest land is steadily decreasing. Today, there are so many people and so many uses for land that forest land must be used for something more than just growing wood.

To meet future demands on shrinking forest acreages, we need to double our total wood production. Scientific timber harvests on commercial forest lands of the United States are meeting our country's wood needs today and we have a favorable timber balance. However, conservationists are growing concerned over our future wood supply.

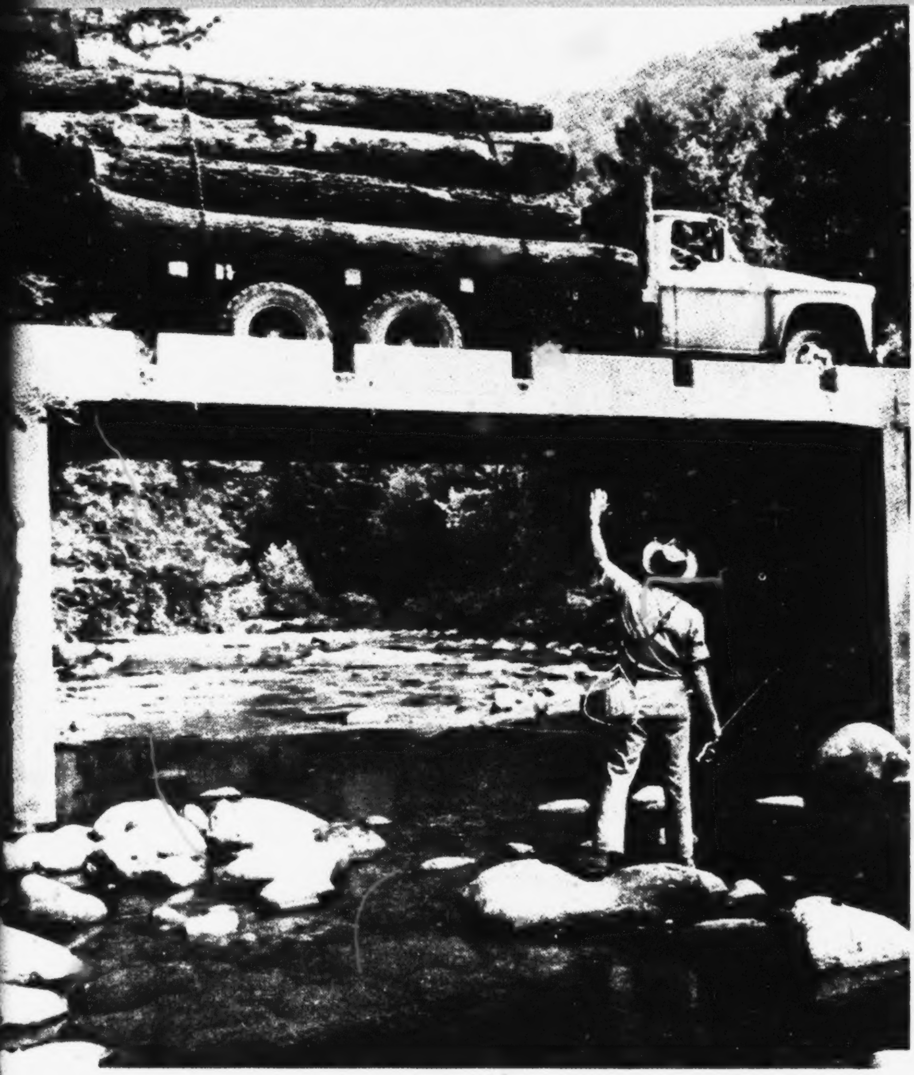
Experts say the U.S. will have 300 million people by the year 2000. That's less than four decades away—less than the usual time for a tree to grow to maturity. This means much more wood will be needed and it means less land to grow it on.

Four steps are important right now. We must—

- plant *billions* of trees instead of millions every year,
- plant or seed all recently cutover lands,
- improve control of fire, insects, and tree diseases,
- make better use of the trees we harvest.

Interrelationships with Other Basic Resources

Good forest management also benefits water, soil, recreation, and wildlife. Managing forest lands for the best combination of uses is called "multiple use." This concept of forest management unlocks the full benefits of the forest for all the population.



Forests provide many things—outdoor recreation and water for cities, as well as timber.

Animals, like this porcupine feeding on a black cherry tree, can destroy much timber.

A new forest generation thrives; an old tree stump offers a seedling moisture, food, warmth. and protection.

These Arkansas 4-H members cut about 100 cords of pulp wood each year, earning money from the tree crop.

Forests and Wildlife

Not all forests have the same kinds and numbers of animals. Foresters and wildlife managers discovered that dense woods made up of large, shady trees, nearly all of one kind, do not produce the most wildlife. Practically all animals need certain plants to furnish their food and certain plants to furnish cover. Sometimes, but not very often, the same plants do both. Generally, several kinds of plants are necessary to support wild animals in any great numbers. Except for the migratory birds, most forest animals live within a relatively small area. The different plants must be close together so they are within range of the animals.

Foresters consider the needs of wild creatures. Areas are sometimes cleared in the forest so that lower-growing food plants can thrive near larger trees that furnish cover for refuge and rest. When timber-producing trees are ready for harvesting, hollow trees that serve as dens for raccoons or special trees that furnish nesting sites for birds may be left standing. Clear-cutting timber in small blocks leaves wooded patches and openings close together, making an excellent wildlife habitat. When trees are planted, openings are left for wildlife, and plants used for food and cover are often included.

Forests and Water

Forest land, in addition to producing timber and wildlife, regulates water flow. Not only do forest soils retain moisture and store water, they also have much to do with controlling water movement both on and beneath the surface.

The speed and volume of water movement through the soil depends on its structure. Any given soil can store only a certain amount of water. The amount of water already in the soil determines how much will be stored during any particular storm—provided the water is able to get in. Good forest soils, which take in water quickly, can hold 50 percent or more of their total volume.

Snow accumulation and melting are also influenced by good forest cover. Protected against sun and wind, snow will remain on the forest floor from 1 to 5 weeks longer than on exposed areas. Also, more of the melting snow is absorbed by the loose, porous, and frequently unfrozen forest soil than by the usually frozen soil of open fields.

When rain falls in the forest, part of it clings to the leaves or needles of trees and other plants, and some trickles down the stems and plant stalks. In a hard or prolonged rain, a considerable amount of water falls directly on the forest floor, filtering into the topsoil and gradually filling its pores. Plants later pull some of this water up into their stems and leaves before giving it off into the air. If the ground cannot take in all the water that reaches it, some runs off over the surface.

The headwaters of nearly all major rivers lie in forests. Well-balanced management of watershed forests recognizes the need for protection of soil and plant cover, an increase in the amount of water taken into the soil, and a reduction in evaporation losses, as well as continuous timber crops. It recognizes that clear water, which furnishes moisture to the forested slopes, is also needed by downstream communities.

What Needs to Be Done

The Chief of the Forest Service has said that forestry deals with people as well as trees. He pointed out:

1. The urgent need to increase the amount of timber that forest land can produce.

2. The growing competition for forest land for other uses.

3. The desirability of multiple use management of forest lands to produce not only more timber, but to provide recreation, wildlife, and water.

4. The need to increase the timber produced on the 4½ million small privately-owned woodlands that make up 56 percent of the Nation's commercial forest land.

Things 4–H Club Members Can Do

1. Tree and Forest Appreciation: Your 4–H members can learn to identify trees. Have them collect leaves, twigs, flowers, and fruit, then mount and label them, using a plant identification key. They can collect and prepare wood specimens, learn uses of wood, make leaf carbons or prints, study how a tree grows, study an individual tree or trees through the seasons, make a plant press. They can color in outline maps showing tree distribution and show natural groupings of trees formed under certain conditions of soil, climate, and topography. Many of these projects make good exhibits, especially if live materials are used.

2. Tree Planting: 4–H members can collect and store seed, establish a small home nursery or a 4–H nursery for planting seeds and cuttings, care for nursery stock, and study areas suitable for tree planting and transplanting. The boy or girl can learn about planting trees—"heeling in", weed control, tree spacing, methods of planting. They can plant trees for landscape, windbreaks, shelterbelts, reforestation, erosion control, wildlife, Christmas trees, etc. They may visit established nurseries and planted areas where machine and hand methods were used. Promote a school forest for the community.

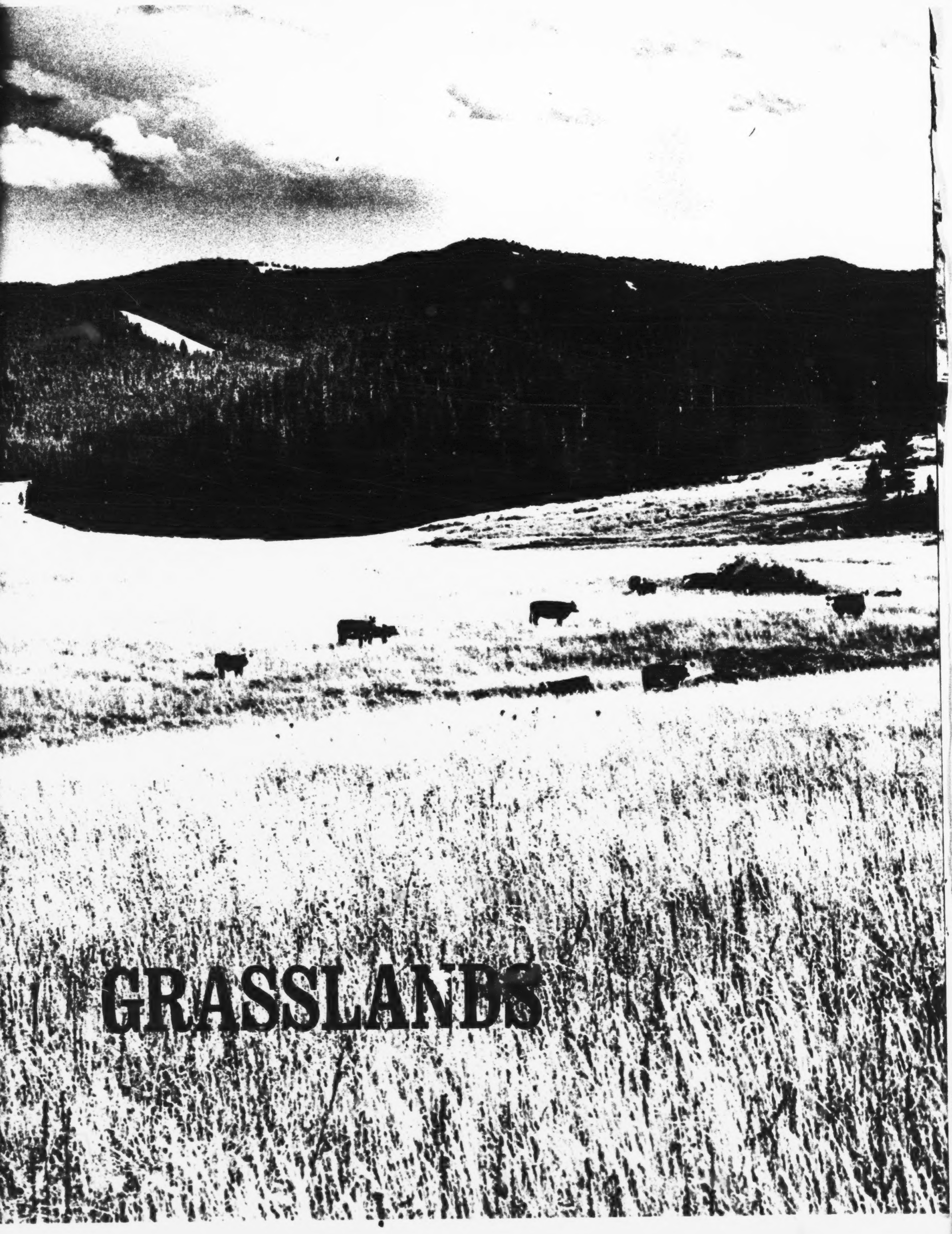
3. Tree and Forest Protection: Young people can learn to protect trees and forests against enemies: fire, insects, disease, livestock, rodents and other wildlife. They may collect samples of damage, photographs, etc. Maps can be used to show the extent of damage. Members can learn to build traps and to use fire tools safely. They can visit fire lookout stations to observe facilities and equipment and visit a burned-over area to see the damage firsthand. These activities also make effective exhibits and demonstrations.

4. Forest Management: Members can establish the corners of a management plot of trees, learn to pace, use a compass, construct a cruising stick, compute tree volumes and tree growth, cruise timber, mark trees for harvest, thin and weed stands, and prune and shear trees. They can study forest influences and wildlife associations. Have them visit a well-managed farm woodlot, a State or National forest or a tree farm, and talk with those in charge.

5. Harvesting and Marketing Forest Products: Have members consider what makes a tree suitable for each outlet—sawlogs, veneer logs, pulpwood, fuel, posts, Christmas trees, naval stores, and maple sirup. Ask some qualified person to teach the 4–H'ers to fell trees and scale logs. If they live on a farm, have them study the logging equipment available. Are manufacturing plants, sawmills, paper mills, veneer plants, shingle mills, or wood preservation plants nearby? Visit one. Learn the sources of raw materials and the final products and distribution. Members can illustrate the different products made from wood, emphasizing new uses for wood that was formerly wasted. Have them learn about woodworking, treating fence posts for farm use, and various forest plants used by florists, druggists, and others.

6. Forest Education: Members can develop forestry talks for local audiences, radio, TV, and civic organizations; prepare exhibits for fairs, schools, museums, and church groups; set up Smokey Bear exhibits. Teach them how to build safe campfires; gather information and references for essays in local papers. Have them study the value of wood products and how the forest industries of the State rank compared to other industries. They can demonstrate the relationship of trees to forest soils in the total environment—soil composition and texture, nutrients, surface litter, moisture, water runoff, insects, worms, rodents, etc.; demonstrate good forestry practices using three dimensional models, photographs, or drawings; and make working models to demonstrate how logs are converted into lumber and other products.

Other projects may be suggested by the references listed in the back of this booklet.



GRASSLANDS

GRASSLANDS

Grasslands are areas covered primarily with grasses and shrubs on which both domestic and wild animals can graze. They may be on farms and ranches, in plains, foothills, or high mountains, and may have scattered stands of timber.

Grasslands include both pasture and range. "Range" covers those wide areas where forage plants grow naturally. "Pasture" usually means an area planted to grasses. It tends to revert to a more natural nongrass covering if man leaves it alone. Although there is no sharp dividing line between pasture and range, ranges generally support mixtures of forage plants, while pastures are more often planted to only a few species.

Grasslands are a vital part of this Nation's natural resources. They are indispensable to the livestock industry, to watershed protection, to wildlife, and to recreation.

History

Both range and pasture lands have played a major role in the settlement and prosperity of the United States. A good climate and an abundance of forage favored cattle and sheep production. As settlers along the eastern seaboard moved west, they cut the forests to provide additional cropland and pasture.

Cattle raised on early western ranges were driven overland to the railroad centers of Kansas and Missouri. On these drives, cattle moved 15 to 20 miles per day and gained weight from eating the abundant grasses along the trail. Some of the most famous trails were the Chisholm, Shawnee, Dodge City, Sedalia, Goodnight, and California.

Droughts and blizzards in the 1800's cut cattle numbers in the Great Plains. Homesteaders arrived in increasing numbers. Sheep were also coming into the area. The competition for grass resulted in the "range wars" now celebrated in fiction and movies. There was overgrazing and the Nation's grass resources deteriorated. Grasslands were further depleted in World War I when demands for wheat resulted in the plowing and planting of thousands of acres of grassland, some of it unsuited to growing crops.

By the early 1940's, the range forage supply in the West and North was getting short, but there was increased demand for livestock products. At the same time, a sharp reduction in cultivated crop acreage occurred in other sections, notably the South. An awakening interest in conservation and the research-proven value of grassland farming led to increased cattle numbers in eastern and southern States. The southern ranges extended over some 197 million acres. Fields were planted to grass and legume pastures, and the native grass range was improved until the grasslands now support large numbers of cattle.

Importance of Grazing Land

Range and pasture are major sources of meat, wool, milk, and leather. Income from livestock is over half of the total agricultural income in the United States. Grass and other feed crops account for more than half this livestock income. In addition, 10 million head of deer, elk, and antelope obtain forage from ranges. Much of our big game hunting is on western rangelands.

A great portion of the water flowing in the streams of America originates on grasslands. This water has a great value for irrigation, power, industry, and domestic purposes. The condition of the range and pasture determines the quality of the water it yields, and influences how fast the water runs off. Bare lands yield floods of muddy water.

Cattle graze on abundant summer range in Montana.

Range and pasture will become still more important. There are surpluses of many agricultural products but there is no surplus of grass. A larger population with changing diet habits is expected to increase the demand for animal products 40 percent in the next 25 years. The Nation must learn to take better care of its remaining range and pasture lands, to produce more grass to feed the larger numbers of animals needed in the future.

Grazing is our largest single use of agricultural lands. In 1959 it was estimated there were 878 million acres of pasture and range. Of this total, 633 million acres were open grasslands and 245 million acres were wooded. Cities, towns, airports, and highways continue to cut into our range and pasture areas. People have more leisure time and they look increasingly to these areas for recreation.

Ownership

Five main groups own or administer the grasslands in this country. Most—about 70 percent—is privately owned. Four percent is owned by States. Fourteen percent is administered by the Bureau of Land Management, 8 percent by the Forest Service and 4 percent is under the direction of the Bureau of Indian Affairs.

Condition

The present condition of the publicly-owned rangelands falls short of demands for livestock and game grazing. Vast areas, particularly in the western mountains, have been damaged by overgrazing to the point where flood and sediment hazards have increased. Both the availability and quality of the water these lands produce is affected.

However, over one million acres of wornout public rangelands in the West have been reseeded in recent years by the Forest Service and the Department of Interior's Bureau of Land Management. Forty-two million acres of privately-owned former cropland and poor range have been seeded in soil conservation districts.

In addition, more than 150 million acres of permanent cover have been established or improved on privately-owned range and pasture land under the Agricultural Conservation Program. Much more of this land rehabilitation is needed and planned. Reductions in the number of animals using the grass will also help many areas recover naturally. However, the net animal production will increase.

Grassland Management

A good range and pasture manager cares for land and uses it economically to get the highest continuous yield of animal products, wildlife, and recreation without endangering the forage, soil, and water resources. Land is kept covered with productive and nutritious forage plants and there is a feed reserve for drought or other emergency. Wise use increases the livestock and wildlife that land can support, increases its water holding capacity, controls soil erosion and evens out the stream flow on watersheds.

Three things must be done to have productive and useful land.

1. Good management must be continued on land that is in good to excellent condition.

2. Management must be improved on land that is in fair to good condition. This may mean fencing, water development, better stock salting practices, changing the season of grazing, or decreasing the number of animals using the area.

3. Land that is in fair to poor condition needs all these things and, in addition, must be restored by reseeding, controlling competing plants, or letting the land rest.

Four steps are important in proper range and pasture management. They are:

- *Inventory*—What is in the range?
- *Evaluation*—What is it good for?
- *Studying trends*—What is happening to it?
- *Making plans*—What to do about it?

The Plants in Grasslands

There may be hundreds of plants on pasture or rangeland but not all are equally important. They are divided into four large groups—grasses, grasslike plants, forbs, and shrubs. This practical grouping is useful in making collections of plants for a herbarium.

Grasses are plants with jointed stems. The stems are generally hollow. Leaves are in two rows on the stem. Veins in the leaves are parallel. Some grasses may live for several years and others only for one. Some are bunchgrasses, that is, they grow in clumps and do not spread out to form a solid mat. Others are sod-formers. They shoot out underground stems (called rhizomes or stolons) that become new grass plants. These grasses tend to form a dense turf. "True grasses", are the most important kind of range and pasture plant. Examples are:

- Orchardgrass (perennial bunchgrass)
- Western wheatgrass (perennial sod-former)
- Bluebunch wheatgrass (perennial bunchgrass)
- Cheatgrass (annual bunchgrass)
- Kentucky bluegrass (perennial sod-former)

Grasslike plants look like grasses but have solid stems with no joints. The leaves are in three rows on the stems. Veins are parallel in the leaves. Most of these plants provide poor forage. Their appearance often indicates rundown land due to too much water or other conditions unfavorable to grasses. Examples are:

- Threadleaf sedge (black fibrous roots, provides good forage)
- Needleleaf sedge (creeping rhizomes)
- Pennsylvania sedge (creeping rhizomes, provides good forage)

Forbs are non-grasslike plants with annual stems (tops) and netlike veins in the leaves. These plants are often called "weeds." *A weed is any plant out of place.* The word "forb" includes broadleafed herbs. Examples are:

- Yarrow (has perennial creeping roots)
- Lupine (has perennial roots)
- Curly Cup Gumweed (has biennial roots)

Shrubs are woody plants with stems that live over the winter and branch from near the base. Examples are:

- Mesquite
- Sagebrush
- Creosote bush
- Juneberry

When animals graze, they eat the plants they like best first. These taste better, smell better or are the right size for animals to bite off easily. If they are still hungry, they will eat less desirable plants.

Forage Values

Plants of *good forage value* taste good, are high yielding and produce a dependable feed supply and soil cover. These include such grasses as the wheatgrasses, bluestems, gramas, orchardgrass, and smooth brome.

Plants of *fair forage value* are nutritious but they either do not taste as good, smell as good, or are harder to graze. They are often very abundant. Examples are buffalograss and redtop. In some areas these may be the best grasses that will grow on a given site.

Plants of *poor forage value* are not very nutritious. Since they usually don't taste too good, animals must be very hungry before they will eat many of them. Witchgrass, carpetgrass, and crabgrass are included in this group in some areas.

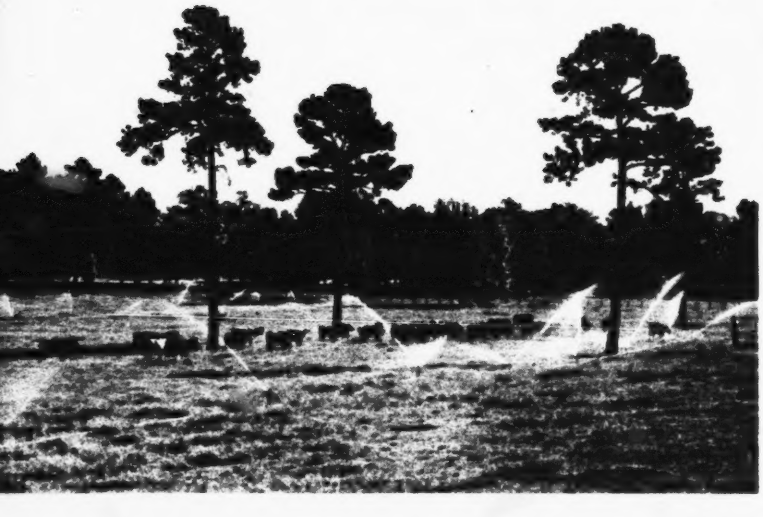
Season of Growth

Some plants make most of their growth in spring and early summer. These are the cool season plants. Other plants make their start in the summer. These are warm season plants. They furnish pasture later in the summer.

Grass is most nutritious when it is green. For this reason, both cool and warm season grasses may be required for the best grazing.

Bison herds once roamed the grasslands of the Great Plains.

Wind-blown soil is destroying this range.



GRASS PLOT
DRY LAND
TOUGHIES
4H CLUB
RANGE-MANAGEMENT-PROJECT

4–H members learn about range management.

Below: Prickly pear and mesquite are among the pests that move into an overgrazed range.

Left: Irrigating improved pasture can increase livestock profits.

Grasslands Change

If grasslands are properly managed, they have the best forage plants or mixture of plants that the climate and soil will support in that location. These plants are able to compete with each other for space, light, and moisture. Where they are grazed too much, the mixture changes.

Since animals eat the plants they like best first, ungrazed plants have a chance to grow and crowd out the plants that are regularly grazed. Thus, these highly preferred, more palatable, plants sometimes called "ice-cream plants", tend to become less abundant. They are known as *decreasers.*

Plants that don't taste as good, or those less affected by grazing, spread into the areas left by the decreasers. For a while, they tend to become more abundant under grazing, and are called *increasers.* If grazing pressure continues, even the increasers may be weakened and replaced by plants of lower forage value called *invaders.* The increasers and decreasers are native plants. Many of the invaders are native but some of them, like dandelion and Russian thistle, are not.

Many people have compared the decreasers, increasers, and invaders to the three colors of traffic lights, calling the decreasers "green". When they are abundant they say "go ahead, graze the pasture or range, but do it right." The increasers are called "yellow". When they are too abundant, they say "caution, proceed with care." The invaders are called "red". When they are abundant, they say "stop! Make adjustments, something is wrong."

These changes in the plant cover may take place very slowly and are influenced by the weather, insects such as grasshoppers, and fires set by nature or man.

The difference between native and introduced plants must be understood before grazing can be managed properly.

Native plants are natural to the area. The gramas, bluestems, wheatgrasses, and fescues are included in this group. Proper grazing is usually the most important practice in keeping such plants vigorous and productive.

Introduced grasses came from other countries and are generally used as pasture plants. Some of these are smooth brome, quackgrass, orchardgrass, timothy, tall fescue, Johnsongrass, and bermudagrass. Special practices, such as proper grazing, fertilizing, mowing, renovation, and reseeding usually are required to keep these pastures productive and free from competing native grasses, forbs, trees, and shrubs.

The following discussion is restricted to native grazing lands.

Range Condition Classes

Excellent condition range: Between 75 and 100 percent of the plants by weight are decreasers. Ranges in excellent condition can be maintained with proper grazing.

Good condition range: Only 50 to 74 percent of the plants by weight are decreasers. Such ranges can be managed to maintain them in good condition or to improve them. This is the most practical condition for the rancher to maintain on his range.

Fair condition range: Only 25 to 49 percent of the plants by weight are decreasers. If desired, the range could be managed to maintain it in fair condition or to improve it. This range could produce 50 to 100 percent more if it were in better condition.

Poor condition range: From 0 to 24 percent of the plants by weight are decreasers. This condition has resulted from very poor management. To improve it may require a combination of rest, seeding, and weed control.

Judging Range

Since ranges in different areas have different soils and climates, the same plants aren't found in all of them. Range scientists recognize these differences and refer to each location as a "range site." Two valuable aids for judging range were prepared by scientists of the Soil Conservation Service, Forest Service, and Bureau of Land Management. One is a Range Site Description for each distinguishably different range location. Such a description includes both the soil and the vegetation. The second is a Range Condition Guide for each range site. This guide tells how much of each group of plant species to count in determining range condition.

Utilization

Each grass, forb, and shrub can be properly grazed without harming its production. "Utilization" means the amount of forage removed from a range or pasture by grazing animals. Utilization can be classed in three categories.

Heavy use leads to a decrease in forage production. It is likely to be harmful to plants, soil, and animals. If grasses are grazed too short, no seed heads are produced and roots are decreased in size and length, causing plants to weaken or die during a drought. In the short run, heavy use tends to give the highest immediate return to the land. But in time, it results in unprofitable returns, trampling, and speeded up water and wind erosion.

Light use, in contrast, tends to lessen immediate returns, but in the long run can hasten recovery and build up litter on rundown grasslands.

Moderate use (proper use) insures protection of soil and forage and provides for sustained yield. "Proper use" for most key range grasses means that about half the total weight of the above-ground part of the plant should be left at the end of the growing season. Pasture grasses used in the humid parts of the country should be allowed a recovery period before winter. Properly used grasses furnish green feed earlier in the spring. The ungrazed forage is not wasted. It is left as a necessary litter to maintain the plants, protect the soil, and hasten water infiltration.

Moderate grazing usually is the best, yields the greatest profit, and still protects the soil. Well managed grasslands produce more forage. More grass means more products—meat, milk, water, and wildlife—and greater net profit.

Things 4–H Club Members Can Do

1. Plant Study: Members can collect, dry, mount, and label the range and pasture grasses, grasslike plants, forbs, and shrubs of the area. Your local county agent, vo-ag teacher, forest ranger, soil conservation technician, or land management specialist can help in this activity.

Members can also take part in a plant identification tour to study grasses, grasslike plants, shrubs, and forbs in their natural habitat. Have the boys and girls learn how plants are classified. They should try to classify each plant they identify by where and when it grows and its forage value.

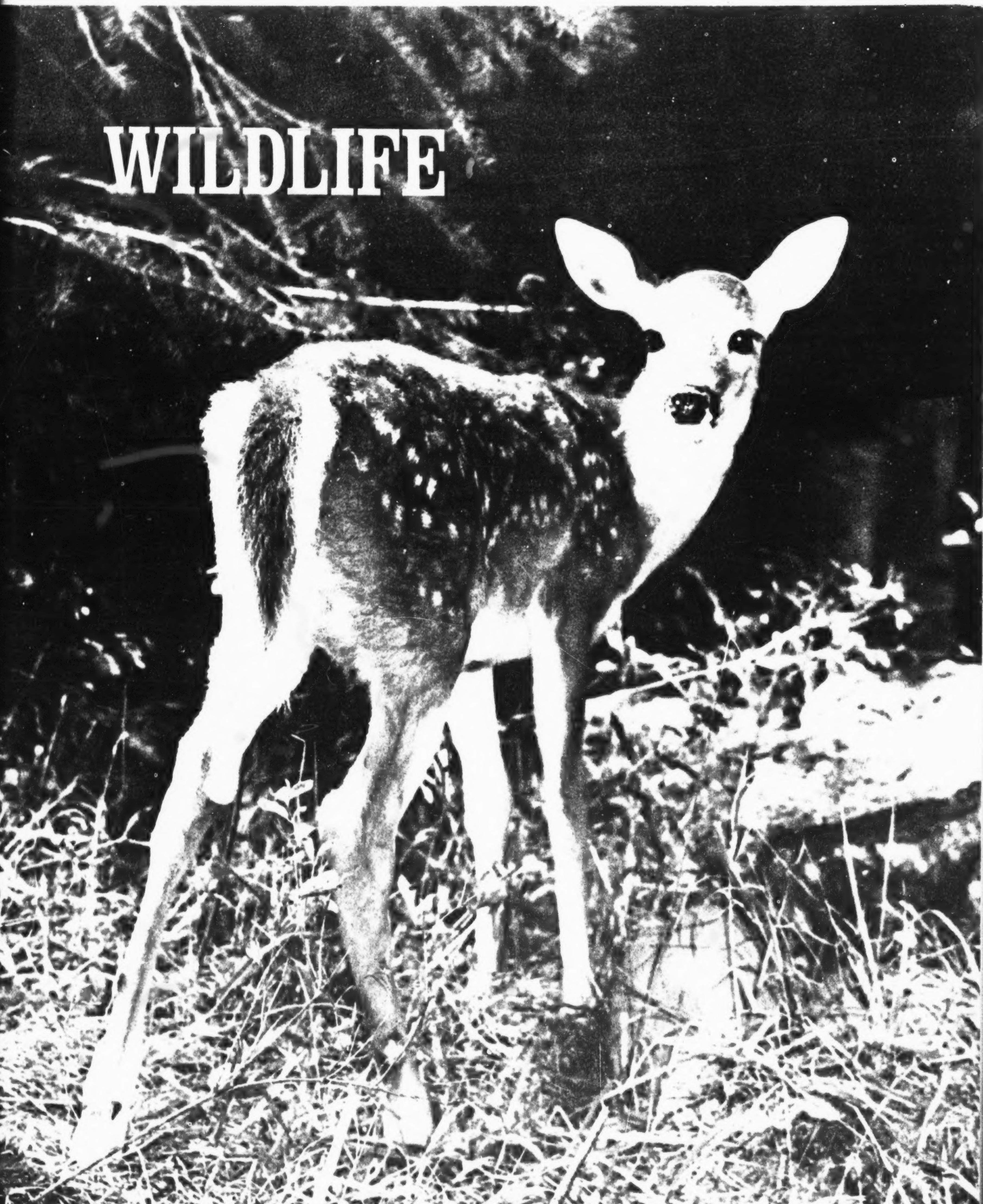
2. Grassland Management: Have members study the effects of burning and overgrazing on the plants and soils of grasslands in the area. Do different animals affect the range or pasture differently? How many animals will good grassland in your community carry? Have club members observe the effects of rodents and other small mammals as well as livestock. Members can study how grass protects soil from erosion and determine the best stubble height to leave for various types of grass. Be sure they understand how important well-managed grasslands are to the American food supply.

3. Field Trip: Arrange a field trip to a demonstration, an experiment station, a soil conservation district or a grazing area to learn scientific methods of range and pasture use and conservation and to study current conditions.

4. Projects: Have members make a survey of the wildlife living on a local range or pasture. 4–H'ers can also replant burned-over or eroded areas with grasses or other cover plants. Many of the activities listed above also make good subjects for demonstrations or exhibits. Other projects may be suggested by the references listed in the back of this booklet.

Wild animals need man's help through interrelated conservation programs.

WILDLIFE



WILDLIFE

For two hundred years, while the settlers of this new land were gaining a foothold, they depended for food and livelihood largely upon two abundant, seemingly unlimited resources—fish and wildlife.

This early abundance of fish and wildlife, coupled with the lessening dependence upon them as Americans spread inland and became busy building industries and cities, lulled us into complacency. With reckless enthusiasm, we helped ourselves to Nature's storehouse, overcultivated the land and lost valuable topsoil which filled streams with fish-destroying silt. Just as thoughtlessly, we plundered our forests with a "there's more where that came from" attitude. We expanded our cities, shrinking the lands which sheltered wildlife. We polluted sky and streams with the wastes of city and industry, endangering fish and birds—and ourselves.

Shore fisheries were worked heavily, and as stocks declined, fishermen had to push farther out to sea to find the harvest.

Gradually men awakened to the dangers of depleting these natural resources, and the Federal Government was given responsibilities for their protection and perpetuation—very limited at first. Then came the drought conditions of the 1930's, soon followed by the meat shortages of World War II, and everywhere Federal, State, and local conservation officials became alarmed.

Early conservation efforts were devoted to propagating fish and acquiring land. Many people still think of conservation in terms of fish hatcheries, bird sanctuaries, and wildlife refuges.

Much quiet work was accomplished in exploratory study of fish, birds, and animals, learning to estimate their numbers, studying their living places and habits, their distribution, their life histories, and the conditions most favorable to their living and reproducing. This information is vitally important to us now.

Importance of Wildlife

Wild things—mammals, birds, and fishes—are primarily a recreational resource, but fish and wildlife also contribute significantly to the national economy. Hunters and fishermen spend more than $3 *billion* annually in pursuit of their sports. Many additional billions are spent by those who use clean water and open country for other recreational activities.

Millions of Americans hunt and fish each year, and their numbers are increasing at a faster rate than the national population. Others enjoy bird watching, wildlife photography, and other forms of nature study.

This public interest makes greater demands upon stocks of wildlife. At the same time, animals are being crowded out of their living areas by urban growth, expanding industrial areas, dredging of shorelines, pollution of streams and estuaries, and draining of marshes. The problem is to preserve or increase the numbers of fish and wildlife in the face of an expanding economy that leaves little room for wild things to survive. Preserving and using wisely the Nation's sport fish and wildlife is a complex operation. We need to plan ahead. We are moving quickly into a period of sharper competition for water and living space.

Fish and wildlife resources must be adjusted to meet changing conditions. Huge dams block the runs of salmon from the ocean to the spawning grounds; irrigation ditches strand fish in a wheatfield; drainage takes the home of the wild duck; an insect spray may kill wildlife; trout can be eliminated by a reservoir. The list of problems is long.

The problems do not solve themselves. People of many talents need to cooperate to carry out the interrelated goals of conservation.

The time is long past when Nature alone adjusted the relationships of fish and wildlife to land, water, and vegetation. Man now helps and hinders the process. The Nation looks to trained conservation workers to provide the "know-how" for adapting our fish and wildlife resources to the everchanging conditions induced by civilization.

Many people do not realize that there is more to fishery management than just stocking a pond or stream with fish, and that releasing land animals in open spaces will not assure a supply of wildlife. Fish and wildlife need food and shelter. When we build a road or a subdivision we destroy wildlife habitat. Therefore, we must create new wildlife areas or make the remaining habitat more productive. No matter how good the habitat, there is a limit to the number of animals it will support.

Water, Land and Wildlife

Part of the answer lies in coordinated, multiple use of water and land. Clear waters needed for fish are also necessary for people and industry. Many kinds of wildlife can live on the land without seriously limiting its other income-producing uses. In fact, abundant wildlife indicates that the basic resources, soil and water, are being wisely used.

More private lands must be managed in ways that will preserve fish and wildlife. We need to encourage private landowners to conserve and develop fish and wildlife, for these people who own and live on the land will help determine the future of the wildlife resource in our country. Such use of private land for public purpose will call for a high level of cooperation and conduct on the part of the owner, conservation groups, government agencies, and the outdoor public.

Fish and wildlife belong to everyone—they are part of youth's heritage—and any person who takes fish and wildlife illegally is actually stealing from his neighbor.

Many people question the policy of harvesting wildlife for sport or recreation. Many shrug off the problem by saying that if man would quit hunting, the problem would solve itself. This is not true. While Nature is bountiful in many ways, she is also very cruel. Living things tend to produce more of themselves than the land can support. When there are more animals than the habitat can support, the number must be reduced. More than one deer has escaped the hunter's bullet in the autumn, only to die a slow death of starvation in the winter.

Land and water will not produce fish and wildlife of the quantity and quality desired unless man helps with his scientific knowledge. But since there are limits beyond which numbers cannot be maintained, man must also keep these numbers in check or Nature will do it.

What Wildlife Needs

All animals must have certain basic things—food, water, cover, and living space. The type and amount of each needed by a given species makes up that animal's "habitat" and determines where the animal will be found.

Any land can be wildlife land. Farmland is especially valuable for small mammals and game birds. Waterfowl, mink, muskrats, and beaver must have streams, ponds, or marshes to survive. Wooded areas support squirrels, deer, and porcupines. Antelope, prairie chickens, and sage grouse are found on open range or grassland.

Most kinds of wildlife require several kinds of "cover" to conceal nests and young, provide shade from the sun and shelter from the rain, allow escape from enemies, and protect them against wintery blasts. Very rarely can one plant meet all the requirements.

Food must be near cover so enemies cannot catch animals off guard. Surface water should also be nearby if the animal uses it. Some kinds of wildlife get all the water they need from their food or from dew.

Some animals need lots of living space. A mountain lion may roam several hundred square miles looking for food. On the other hand, some small mammals may never travel more than one hundred feet from their home. Any animal must be able to find the kind of food and cover it needs within the area it travels regularly.

Each animal must have a certain amount of "elbow room"—the amount depends on the species. This determines how dense any animal population can become. Most animals have a "territory" at certain times. This is an area, usually right around the home or nest, that the animal will defend against members of its own species and, occasionally, others. Many birds gladly share the tree they nest in with birds of other species, but chase off any of their own kind.

Each animal fills a slightly different niche in nature. A chipmunk and a cottontail can live on the same plot of ground because they don't eat the same things and don't interfere with each other. The number of any kind of animal an area can support is called that land's "carrying capacity." This varies with the seasons and many other factors.

During favorable periods, wildlife numbers increase rapidly. If they get too numerous, they can actually eat themselves out of house and home. The annual crop must be harvested to maintain populations that the land can support during unfavorable periods. A healthy animal that doesn't have to compete with too many others for its food is in better condition to avoid predators and withstand disease, parasites, and winter weather. Land that isn't eaten bare is in better condition to support a new crop of wildlife the next year.

Wildlife Management and Research

The practice of bringing fish and wildlife up to desired numbers and quality and then holding it in check is called "management." Research is a tool of management.

Some background on fish and wildlife management and research may help you explain to your 4-H'ers how their projects fit into the conservation picture.

The agencies primarily concerned with fish and wildlife are the State fish and game and/or conservation departments, the U.S. Department of the Interior's Fish and Wildlife Service, and various national, State, and local associations. Colleges and universities give courses on fish and wildlife.

Very important are private landowners whose property is estimated to provide more than 80 percent of the small game and game bird hunting, and on whose land there is also some big game and waterfowl harvest. The private landowner has the right to say who may hunt or fish on his property.

Most fish and wildlife management is up to the States and their laws on hunting and fishing vary. State hunting and fishing licenses are necessary. A Federal duck stamp is also needed for waterfowl.

The U.S. Fish and Wildlife Service manages more than 28 million acres of refuges and ranges. These are not only fish and wildlife havens but also huge outdoor laboratories where management problems are studied. It operates 60 biological, technological, and fishing gear research stations and laboratories and nearly a score of vessels to investigate commercial fishery problems. Its sport fisheries laboratories and field stations study fish diseases, nutrition, husbandry, and environmental influences. Two large wildlife research laboratories and their field stations study pesticides, wildlife diseases. animal control, the relationship of animals to reforestation, and other problems.

Each State fish and game department does research. Private and semipublic organizations are also engaged in fish and wildlife research. Colleges maintain laboratories and conduct cooperative programs with their respective States and the Fish and Wildlife Service. Other State and Federal agencies that deal primarily with land and water are conscious of their stewardship of the fish and wildlife within their jurisdiction. They realize that fish and wildlife, land and water, forests and range are a "package."

The Fish and Wildlife Coordination Act makes fish and wildlife part of the overall resources to be considered in Federal water development programs—reservoir and irrigation projects, for example.

Small and large watershed protection projects come under this legislation. Months, and often years, of hard, silent work—some of it research and some of it informing the public—often are necessary before a project is completed. Biologists, economists, engineers, water experts, and health officials work together to fit fish and wildlife into other project plans.

Other important Federal laws are *Federal Aid for the Restoration of Wildlife* (Pittman-Robertson), and *Federal Aid for the Restoration of Fish* (Dingell-Johnson)—two acts which provide for a manufacturers' tax on sporting guns and ammunition and on rods, reels, creels, and artificial lures. This money gives States funds for fish and wildlife programs.

Research Projects

Reservoir Research—In this country there are more than 23,000 square miles of surface water in large manmade reservoirs. All should be good fishing spots, but many are not. Recently the Federal Government authorized research to learn why a new reservoir provides fine fishing for a few short years and then usually declines to a less than mediocre fishing place.

Selective Breeding of Fish—Selective breeding of unconfined fish offers problems, but biologists feel that hatchery-reared fish can be tailored to the needs of sport fishing. Scientific selection can produce fish with higher or lower rates of production, death, and growth. Breeding can produce strains with greater stamina, wariness, disease resistance. Much work is also being done to breed disease-resistant strains of shellfish.

Fish Diseases—Disease constantly threatens many kinds of fish and is important in hatcheries. There's been progress in detecting and controlling viral, bacterial, parasitic, and nutritional diseases, bringing greater hatchery production and healthier fish to stock.

Farm Pond Management Research—Farm ponds offer fishing for food and fun, but only a few are being properly managed. Often the wrong kind or amounts of water plants fill the pond. Imbalanced fishing may result in more poor quality fish or stunting. Periodic "clean-ups" and restocking programs keep some ponds producing food fish.

Sportsman-Farmer Relationship—About 80 percent of small game hunting is done on private property. Good farming can and usually does go hand in hand with wildlife management, and increased wildlife on the farm can add to the farmer's income. Hunting for a fee is becoming more common. A farmer can increase wildlife without reducing agricultural production, and it is to his benefit to do so. Research now gives the landowner information he needs to manage his property in a way that assists wildlife.

Protection of Plants through "Systemics"—Reforested areas and other plantings are often injured or destroyed by animals. Destroying wildlife is the last resort, to be used only when repellants have failed. One of the most promising techniques found by research is "systemics", a method in which a repellent is added to the soil, picked up by plant roots, and then carried to the tender shoots of the plant. It remains in the part of the plant where it is needed for several months or years, discouraging animals from eating the plant. Research is still to be done on this, including its effect on man and beneficial animals.

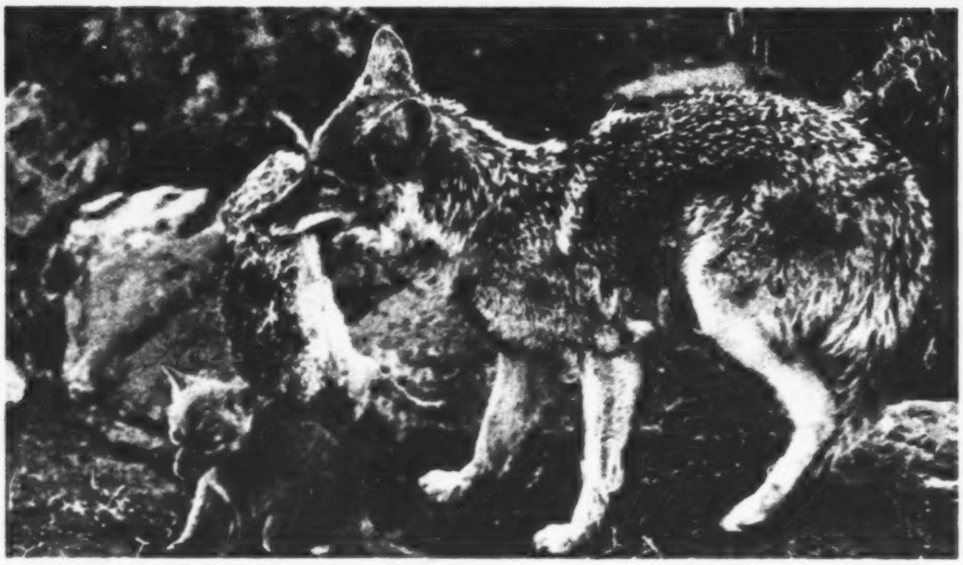
Seed Protection by "Education"—Research has shown that it often is useless to rid a planted area of field mice or other small animals because similar animals from over the hill would move into the vacant "territory". But when mice eat seeds that contain only enough poison to make them ill, they usually learn to touch no more of those seeds. They then are there to protect their "territory" from invaders and, as such, actually become guardians of the seed bed.

Pesticide Research—One threat to fish, wildlife, and possibly to man in modern times is the increased use of the pesticides necessary to protect crops. This problem became of such national concern that Congress has authorized and is financing a long-range investigation on pesticide-wildlife relationships. The aim is to develop materials and methods of application that will give crops the protection they need— but not at the expense of fish and wildlife.

Wildlife Management Research—Good examples of wildlife management research are the migratory waterfowl and mourning dove programs. Bird banding and surveys showed that birds migrate north and south across the United States along four wide corridors or flyways—the Atlantic, Mississippi, Central, and Pacific Flyways. Studies found, for instance, that the typical mourning dove will be hatched, reared, migrate, and die within the same flyway. This permits management by flyways or units rather than on a nationwide basis.

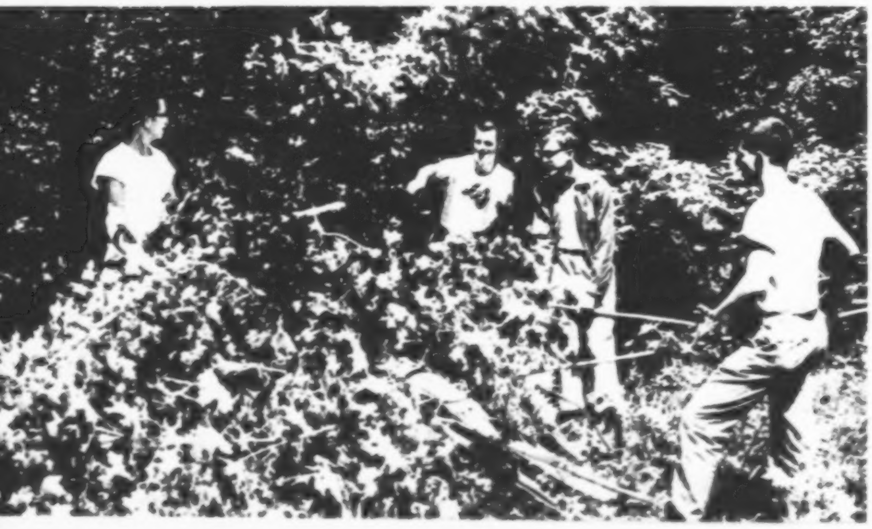
Installing a fox trap. A wildlife crop is renewable but should be harvested in accordance with the law.

Foresters often leave "den" trees like this as a home for wildlife.



Coyotes and other predators help keep game populations in check.

4-H members build a brush pile for wildlife cover.



Ptarmigan show protective winter coloration against snow.

Exotic Bird Programs—When changes in an area drive out native game birds, or when areas lack such birds, it is sometimes possible to find foreign species that are desirable, will survive, and will not compete with native species for food, cover, and water. The exotic, or foreign, game bird program began in 1948. Scientists studied habitats and tried to find foreign birds that would survive in America but would not become pests as did the English sparrow and the starling, introduced earlier. They considered biological, climatic, geographic, and topographic features. Eighteen species, out of nearly 1,000 species and sub-species considered, have been tried in this country since 1950. Nearly 16,000 individual birds have been imported and released in various sections of the country. So far, none has been as successful as or fine a game bird as the pheasant, introduced many years ago from Asia.

Control of Blackbirds—Each year, damage by blackbirds and starlings amounts to many millions of dollars. There are three approaches to this problem. One is to destroy the birds. Another is to discourage them with chemical repellents or noisemakers. A third approach is to develop plants that are bird resistant or that mature early enough to be harvested before the birds start flocking together in the fall. Considerable progress has been made, but a great deal more research needs to be done before this problem is solved.

Future of Wildlife in America

There is little prospect that the demands on our wildlife resources for food, industrial products, and recreational use will lessen. Instead, these demands are more likely to increase. There is also every prospect that our civilization, so destructive of wildlife in the past, will be no less destructive in the future unless the public becomes "conservation conscious". The survival of wildlife can never be taken for granted.

Things 4–H Club Members Can Do

1. Field Trips: Contact your county agent for help in arranging field trips with fish and game personnel or foresters. Fish hatcheries, wildlife refuges, bird sanctuaries, wild areas, and dams with fish ladders or other devices are good places to visit.

2. Nature Study: Members can develop a nature trail in their community. They should learn to identify the birds, mammals, reptiles, fish, and insects common to the area. This includes knowing their tracks, general habitat, homes, and food. Some members may wish to make track casts. Every 4–H'er interested in conservation should know his State's fish and game laws.

3. Home Ground Improvements: Members can make their home grounds more attractive to birds by erecting bird houses and winter feeding stations and by using food-bearing plants in landscaping.

4. Habitat Improvement: Members can help build or develop a farm pond, lake, or reservoir for fish and wildlife and for recreational use. They can also restore or improve a marsh area for wildlife use. Some State fish and game or conservation departments offer "wildlife bundles", groups of plants that are beneficial to wildlife, for interested people to plant around farm ponds, along gullies and ditches, or in other wasted areas. Contact them if your 4–H Club members show an interest in this activity. Members can also establish food patches, such as suitable small grains, to be left standing for wildlife winter use. This activity is more effective when trees and shrubs are also planted in the area for reforestation and wildlife cover.

5. Other Projects: Members can make a scrapbook showing pictures of wildlife, their habitat, and their food. Try to have them include a write-up of the animal's life history. 4–H'ers may want to maintain a bulletin board with pictures and lists of the wildlife they have seen recently. Boys and girls can make a survey of wildlife in the area, noting the plants used as food, cover, shelter, nesting materials, etc. They may also want to establish a permanent feeding shelter in a draw, at the edge of a wooded tract, on rough unpastured land, near marshes or bogs, or in a fence corner. Many of the activities listed above make good demonstrations or exhibits. Other activities may be suggested by the references listed at the back of this booklet.

Consult your local State fish and game department, conservation department, or other appropriate agency for technical instructions on these projects or other local ones.

REFERENCES

You may be able to find many of these publications and others on the same subjects in your libraries. Some of the references listed here are for club members as well as for you. Your county agent, soil conservationist, forester, or fish and game warden can help you with your projects and may be able to suggest other books and materials you can use to teach your 4–H Club members.

Ask your county agent to arrange for the use of any films you may want to show. Most of the films listed in this chapter were produced by the U.S. Department of Agriculture and are available through State film libraries. Information on films marked (USDI) may be obtained by writing to the Office of Information, Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C., 20240.

Note: Prices quoted here for books are subject to change. Before ordering, request price quotations and ask for educational discount.

General

The Web of Life: A First Book of Ecology, John H. Storer. Devin-Adair Co., 23–25 E. 26th Street, New York, N.Y. 1953. $3.50. Also available in paperback from The New American Library of World Literature, Inc., 501 Madison Avenue, New York, N.Y. $.60.

Very good explanation of the interrelationships among living things. Age 12 and up.

Land, People, and History, Elizabeth S. Helfman. David McKay Co., Inc., 119 W. 40th Street, New York, N.Y. 1962. $4.95.

Provides a basic understanding of land use and what must be done to prevent waste by erosion. Age 10 and up.

Conservation Directory, National Wildlife Federation, Educational Servicing Section, 1412 Sixteenth Street NW., Washington, D.C., 20036. Published annually. $1.00.

Lists organizations and agencies concerned with conservation. For leaders.

An Outline for Teaching Conservation in Elementary Schools, PA–268. Single copy free from any Soil Conservation Service field office.

Things To Do in Science and Conservation, Byron Ashbaugh and Muriel Beuchlein. Interstate Printers and Publishers, Inc., Danville, Ill. 1960. $2.50.

Conservation Activities for Young People. Single copy free from the Forest Service, U.S. Department of Agriculture, Washington, D.C., 20250.

Suggests practical field trips, demonstrations, experiments, exhibits, posters, and conservation topics.

Multiple Use for Food, Fiber, Fuel and Fun, National Wildlife Federation, Educational Servicing Section, 1412 Sixteenth Street NW., Washington, D.C., 20036. Single copy free, each additional copy 10 cents.

Explains what multiple use of resources means.

Films

The Land Changes, 16 mm., color, 15 minutes. The story of how wornout land can become a real asset to a local community.

Lifeblood of the Land, 16 mm., color, 19 minutes. Shows dangers of overcutting, overgrazing, and erosion.

The River, 16 or 35 mm., black and white, 32 minutes. Dramatic documentary of the Mississippi River—what it has done and what man has done to it.

Woodland Manners, 16 mm., color or black and white, 19 minutes. Shows that it is up to everyone who uses the forest to use good manners and to leave the area in as good or better condition than he found it.

Soil

Soil, 1957 Yearbook of Agriculture. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. $2.25.

A Field Guide to Rocks and Minerals, F. H. Pough. Houghton-Mifflin Company, 2 Park Street, Boston, Mass. $4.95.

Many illustrations in full color.

Soil Savers: The Work of the Soil Conservation Service, C. B. Colby. Coward-McCann, Inc., 200 Madison Avenue, New York, N.Y. 1957. $2.00.

Pictorial story of soil and water problems, conservation practices to combat them, and conservation district programs. Ages 9–15.

Dust Bowl: The Story of Man on the Great Plains, Patricia Lauber. Coward-McCann, Inc., 200 Madison Avenue, New York, N.Y. 1958. $2.95.

Deals with wind, weather, dust storms, and what farmers and ranchers are doing to prevent further erosion of their land. Ages 9–15.

Soil and Water Conservation Projects and Activities—A Guide for 4–H Club Leaders, PA–377. Single copy free from your county agent.

Single copies of the following booklets are available free from any Soil Conservation Service field office.

Conquest of the Land Through 7,000 Years, AB–99.

The Soil That Went to Town, AB–95.

Sediment Is Your Problem—Wasted Soil and Water, AB–174.

Soil Conservation at Home: Tips for City and Suburban Dwellers, AB–244.

Soil Erosion—The Work of Uncontrolled Water, AB–260.

Know Your Soil, AB–267.

The Measure of Our Land, PA–128. Explains in simple language what is meant by the national land-capability inventory the Soil Conservation Service is making.

Films

The Dust Is Dying, 16 mm., color or black and white, 13½ minutes. Shows how farmers and ranchers of the Great Plains are preparing as never before to prevent disaster when the next, inevitable drought comes.

Raindrops and Soil Erosion, 16 mm., color, 21 minutes. A technical subject explained in a simple, interesting, nontechnical manner.

Topsoil, 16 or 35 mm., black and white, 11 minutes. Tells the story of the thin layer of topsoil on which both city and rural people depend for most of their food, clothing, and other necessities. Age 10 and up.

Water

Water, 1955 Yearbook of Agriculture. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. $2.25.

Water for America: the Story of Water Conservation, Edward H. Graham and William R. Van Dersal. Henry Z. Walck, Inc., 19 Union Square W., New York, N.Y. 1956. $3.75.

A comprehensive survey of water conservation in America for ages 12–15.

Water: Riches or Ruin, Helen Bauer. Doubleday & Co., Garden City, L.I., N.Y. 1959. $3.00

Describes the interrelationships of water and other resources and conservation practices in the management of water and land in watersheds supplying cities. Age 9 and up.

Exploring the River, John and Jane Greverus Perry. McGraw-Hill Co., 330 W. 42d Street, New York, N.Y. 1960. $3.50.

A story of soil and water conservation and the role of rivers and watersheds in American life. Ages 10–15.

Water, National Wildlife Federation, Educational Servicing Section, 1412 Sixteenth Street NW., Washington, D.C., 20036. Single copy free, each additional copy 10 cents.

A brief, elementary description of water resources and the part man can play in protecting them.

Soil and Water Conservation Projects and Activities—A Guide for 4–H Club Leaders, PA–377. Single copy free from your county agent.

Films

Water for Farm and City, 16 mm., black and white, 13½ minutes. Portrays various effects of water upon the land and its people.

Mountain Water, 16 mm., color, 17 minutes. Shows the function of mountain vegetation in conserving and regulating water supplies for industrial, agricultural and domestic use.

Snow Harvest, 16 mm., color, 24 minutes. Shows techniques of measuring snow to forecast irrigation and other water supplies. Beautiful winter scenery. All ages.

Forests

Trees, 1949 Yearbook of Agriculture. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. $2.75.

Knowing Your Trees, Collingwood and Brush. American Forestry Association, 917 Sixteenth Street, Washington, D.C., 20006. 1956. $6.00.

A well-illustrated guide to 161 tree species. Covers the entire United States and includes range maps of the species discussed.

A Field Guide to Trees and Shrubs, G. A. Petrides. Houghton-Mifflin Company, 2 Park Street, Boston, Mass.

Covers northeastern and central North America. Many illustrations in full color.

Forestry Activities (for the Scoutmaster). American Forest Products Industries, Inc., 1816 N Street, Washington, D.C., 20036. Single copies free on request.

Single copies of the following are free from the Forest Service, U.S. Department of Agriculture, Washington, D.C., 20250. *Additional* copies are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. at the prices listed.

Protecting the Forests From Fire, AB–130, 15 cents.

Look to Your Timber, America, MP–766, 20 cents. Tells the story of our timber situation today—and takes a look into the future.

Wood—The Material of a Thousand Uses, K–27. (Not available in quantity.)

Forest Regions of the United States, V–1. (18 x 21 inch map) 10 cents. Shows and describes forest regions; lists principal trees of each. For upper elementary and high school grades.

The National Grasslands Story, PA–607, 20 cents. Tells the story of the 19 National Grasslands managed by the Forest Service.

Trees of the Forest, Their Beauty and Use (including teacher's guide), PA–613, 20 cents. The story of growing trees and timber on the National Forests. The teacher's guide includes suggestions for indoor and outdoor projects.

Timber Resources Review Fact Sheets. Set of 13 discussion leaflets.

Forestry Activities (a guide for Youth Group Leaders), PA–457. 15 cents.

Films

Days of a Tree, 16 mm., color or black and white, 28 minutes. A boy and his Dad visit Dad's boyhood fishing spots, only to find them laid waste by forest fires. Dad shows son fire prevention and control measures being used.

The Forest, 16 mm., color or black and white, 28 minutes. Relates the multiple use benefits to be obtained from the National Forests.

Smokejumpers, 16 mm., color or black and white, 10 minutes. Shows how the U.S. Forest Service has developed its own airborne squadron to combat forest fires in remote, roadless areas. All ages.

This is Your Forest, 16 mm., color, 9 minutes. A simple story of a ranger explaining what his district is "for" to two Boy Scouts.

Water for the West, 16 mm. Color or black and white, 25 minutes. Shows work of forest rangers and scientists to increase the water yield from the Rocky Mountain country.

Wilderness Encampment, 16 mm. Color, 27½ minutes. A Senior Girl Scout backpacking trip into the Three Sisters Wilderness Area on the Deschutes National Forest in Oregon.

Grasslands

Grass, 1948 Yearbook of Agriculture. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. $2.00.

Manual of the Grasses of the United States, MP–200. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. $3.75.

Complete identification manual for leaders and older youth. Fairly technical. Available in many libraries.

First Book of Grasses, Agnes Chase. For sale by the Smithsonian Institution, Washington, D.C., 20560. $3.00.

On the structure of grasses; will enable club leaders and older youth to use botany manuals and other technical works for identification purposes. Illustrated.

Pasture and Range Plants, Phillips Petroleum Company, 476 Adams Building, Bartlesville, Okla. 1963. $5.95.

Contains 178 lifelike water-color reproductions of plants commonly found in pastures and ranges of the United States. Included are detailed descriptions of the plants, their uses and forage value, their scientific and common names, and their distribution. Age 12 and up.

Classifying Rangeland for Conservation Planning, AH–235. Single copy free from any Soil Conservation Service field office.

Films

Grass: The Big Story, 16 mm., color, 20 minutes. The story of an indispensable crop.

Rangeland Research at Manitou, 16 mm., color, 20½ minutes. Shows the various experiments at the Manitou Experimental Forest, Colorado, featuring the effects on land and water of different degrees of grazing.

Rebuilding With Grass, 16 mm., color or black and white, 20 minutes. Ranchers in Idaho, Utah, Nevada, and New Mexico tell about their work in reseeding and improving the management of their own lands.

Wildlife

Our Wildlife Legacy, Durward L. Allen. Funk and Wagnalls Co. Inc., 360 Lexington Avenue, New York, N.Y. 1962. $6.50.

Basic text on principles of wildlife management. Age 14 and up.

The Land and Wildlife, Edward H. Graham. Oxford University Press, 417 Fifth Avenue, New York, N.Y. 1947. $5.00.

Fairly technical guide to management of wildlife through land use. For leaders.

Peterson Field Guide Series, Houghton-Mifflin Company, 2 Park Street, Boston, Mass. Basic books for field identification. Many illustrations in full color.

A Field Guide to the Birds, R. T. Peterson. $4.95. Covers eastern and central North America.

A Field Guide to Western Birds, R. T. Peterson. $4.95.

A Field Guide to the Mammals, W. H. Burt and R. P. Grossenheider. $4.50.

The Farmer and Wildlife, Durward L. Allen. Wildlife Management Institute, 1000 Vermont Avenue, NW., Washington, D.C., 20005. 1949. Single copy free on request.

Gives dozens of practical suggestions on how to improve land and wildlife conditions. Well-illustrated. Age 12 and up.

Making Land Produce Useful Wildlife, FB–2035. Single copy free from any Soil Conservation Service field office.

Sportsman's Stake in Agricultural Conservation, PA–603. Single copy free from USDA, Washington, D.C., 20250.

Single copies of the following publications may be obtained free from the National Wildlife Federation, Educational Servicing Section, 1412 Sixteenth Street NW., Washington, D.C., 20036. *Additional* copies are priced as listed

HABITAT IMPROVEMENT: KEY TO GAME ABUNDANCE. 10 cents.

HOMES FOR WILDLIFE. 5 cents.

The following publications may be obtained for 15 cents each from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. Excerpts are available free from the Office of Information, Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C., 20240.

ATTRACTING BIRDS, CB–1.

HOMES FOR BIRDS, CB–14.

Films

REALM OF THE WILD, 16 mm., color, 27 minutes. Shows several big game animals and many birds and smaller animals in their National Forest haunts.

WE SHARE THIS LAND, 16 mm., color, 14¼ minutes. Story of how conservation practices bring beneficial wildlife back to the farm.

WILDLIFE AND THE HUMAN TOUCH, 16 mm., color or black and white, 18 minutes. Shows forest animals and what the Forest Service is doing to improve their habitat and manage the forests for the benefit of all.

BEHIND THE FLYWAYS, 16 mm., color, 28 minutes (USDI). The story behind waterfowl regulations as seen through the eyes of a hunter. Beautiful and interesting photography of ducks and geese.

FISHING FIVE GREAT LAKES, 16 mm., color, 28 minutes (USDI). Deals with the natural resources of the Lakes, with emphasis on commercial and interrelated problems.

ACKNOWLEDGMENTS

Since it's original appointment, the National 4–H Developmental Committee on Conservation of Natural Resources has included the following State and Federal Extension Service members, consultants and special representatives.

Members:

W. Robert Amick, Associate in 4–H Club Work, Purdue University, West Lafayette, Ind.—Chairman.

Glenn T. Baird, State 4–H Club Leader, Utah State University, Logan, Utah.

Rex F. Campbell, Associate Professor and Supervisor, Montana State College, Bozeman, Mont.

Dr. George S. Foster, 4–H Club Specialist and Leader, University of Tennessee, Knoxville, Tenn.

C. Dorsey Dyer, Head, Extension Forestry Department, University of Georgia, Athens, Ga.

Robert W. George, Extension Specialist in Conservation Education, Michigan State University, East Lansing, Mich.

Carl W. Herzman, Agricultural Programs Leader, Extension Service, Colorado State University, Fort Collins, Colo.

Maurice L. Hill, Program Leader, 4–H and Youth Development, Federal Extension Service, USDA, Washington, D.C.

Kenneth Ousterhout, Assistant State 4–H Club Leader (Emeritus), Michigan State University, East Lansing, Mich.

Lloyd L. Rutledge, Program Leader, 4–H and Youth Development, Federal Extension Service, USDA, Washington, D.C.

Dr. John B. Sharp, Extension Forester, University of Tennessee, Knoxville, Tenn.

Arthur M. Sowder, Federal Extension Service, USDA, Washington, D.C.

Wendell R. Tasher, Extension Soil Conservationist (Emeritus), Federal Extension Service, USDA, Washington, D.C.

Edward J. Williamson, Extension Specialist, Soil and Water Conservation, Federal Extension Service, USDA, Washington, D.C.

W. Sherard Wilson, State 4–H Club Agent, University of Maryland, College Park, Md.

Robert G. Wingard, Chairman, Forestry and Wildlife Management Extension, Pennsylvania State University, 111 Forestry Building, University Park, Pa.

Consultants and Special Representatives:

Kenneth H. Anderson, Associate Director, National 4–H Service Committee, Inc., 59 East Van Buren Street, Chicago, Ill.

Byron L. Ashbaugh, Associate Director, Nature Centers Division, National Audubon Society, 1130 Fifth Avenue, New York, N.Y.

Dr. Matthew J. Brennan, Chief of Conservation Education, U.S. Forest Service, USDA, Washington, D.C.

Dr. F. Olin Capps, Chief, Special Program Services, Fish and Wildlife Service, Department of the Interior, Washington, D.C.

Chalmers Cooper, U.S. Geological Survey, Department of the Interior (Emeritus), Washington, D.C.

Jack C. Culbreath, Director of Information and Education, U.S. Forest Service, USDA, Juneau, Alaska.

Jack Durham, Division of Water Supply and Pollution Control, Department of Health, Education, and Welfare, Washington, D.C.

Adrian C. Fox, Head, Education Relations Section, Program Services Branch, Information Division, Soil Conservation Service, USDA, Washington, D.C.

Paul M. Galbreath, Associate Extension Soil Conservationist, University of Maryland, College Park, Md.

Stanley M. Jepsen, Executive Assistant, American Forest Products Industries, Inc., 1816 N Street, NW., Washington, D.C.

C. W. Mattison, Education Section, U.S. Forest Service (Emeritus), USDA, Washington, D.C.

James C. McClellan, American Forest Products Industries, Inc., 1816 N Street, NW., Washington, D.C.

George McCullough, Wildlife Technician, Federal Cartridge Corporation, Minneapolis, Minn.

H. D. Millhone, Firestone Tire and Rubber Company, Akron, Ohio.

Many others have also served as special subcommittee members in developing portions of this leaders guide.

OUTDOOR GOOD MANNERS

Always ask permission before entering private property. Show an interest in the owner's welfare. Make sure gates are closed when leaving property. Don't disturb livestock. Avoid trampling crops. Don't damage fences. Don't deface property. Be careful with fires—crush out smokes, drown campfires. Don't be a "litterbug". Treat the property of others as you would your own.

Cooperative Extension Work: United States Department of Agriculture and State Land-Grant Colleges and Universities Cooperating.
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